



Monterey Bay Aquarium Seafood Watch

Freshwater Fish, Lake Michigan

Coregonus clupeaformis, Salvelinus namaycush, Sander vitreus



America, North—Inland Waters

Stationary uncovered pound nets, Set gillnets, Bottom trawls

Report ID 27855

July 1, 2024

Seafood Watch Standard used in this assessment: Fisheries Standard v4

Disclaimer

All Seafood Watch fishery assessments are reviewed for accuracy by external experts in ecology, fisheries science, and aquaculture. Scientific review does not constitute an endorsement of the Seafood Watch program or its ratings on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this assessment.

Table of Contents

Table of Contents	2
About Seafood Watch	3
Guiding Principles	4
Summary	5
Final Seafood Recommendations	7
Introduction	10
Criterion 1: Impacts on the species under assessment	19
Criterion 1 Summary	19
Criterion 1 Assessments	20
Criterion 2: Impacts on Other Species	47
Criterion 2 Summary	48
Criterion 2 Assessment	52
Criterion 3: Management Effectiveness	56
Criterion 3 Summary	56
Criterion 3 Assessment	59
Criterion 4: Impacts on the Habitat and Ecosystem	75
Criterion 4 Summary	75
Criterion 4 Assessment	76
Acknowledgements	86
References	87

About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the environmental sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Seafood Watch's science-based ratings are available at www.SeafoodWatch.org. Each rating is supported by a Seafood Watch assessment, in which the fishery or aquaculture operation is evaluated using the Seafood Watch standard.

Seafood Watch standards are built on our guiding principles, which outline the necessary environmental sustainability elements for fisheries and aquaculture operations. The guiding principles differ across standards, reflecting the different impacts of fisheries and aquaculture.

- Seafood rated Best Choice comes from sources that operate in a manner that's consistent with our guiding principles. The seafood is caught or farmed in ways that cause little or no harm to other wildlife or the environment.
- Seafood rated Good Alternative comes from sources that align with most of our guiding principles. However, one issue needs substantial improvement, or there's significant uncertainty about the impacts on wildlife or the environment.
- Seafood rated Avoid comes from sources that don't align with our guiding principles. The seafood is caught or farmed in ways that have a high risk of causing harm to wildlife or the environment. There's a critical conservation concern or many issues need substantial improvement.

Each assessment follows an eight-step process, which prioritizes rigor, impartiality, transparency and accessibility. They are conducted by Seafood Watch scientists, in collaboration with scientific, government, industry and conservation experts and are open for public comment prior to publication. Conditions in wild capture fisheries and aquaculture operations can change over time; as such assessments and ratings are updated regularly to reflect current practice.

More information on Seafood Watch guiding principles, standards, assessments and ratings are available at www.SeafoodWatch.org.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished¹ or farmed, that can maintain or increase production in the long term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered, or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function, or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard. Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, Seafood Watch develops an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guides and online guide:

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught, farmed or managed.

Avoid/Red: Take a pass on these for now; they're caught or farmed in ways that harm other marine life or the environment.

¹ "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

Summary

This report evaluates the commercial harvest of lake whitefish (*Coregonus clupeaformis*), lake trout (*Salvelinus namaycush*), and walleye (*Sander vitreus*) in the waters of Lake Michigan (including Green Bay), which encompasses both state-licensed fisheries (Michigan and Wisconsin) and tribal-licensed fisheries (Michigan). Lake whitefish may be caught using trap nets, large-mesh gillnets, or bottom trawls, depending on the region, and lake trout and walleye are caught using either trap nets or large-mesh gillnets.

The Wisconsin state-licensed trap net and large-mesh gillnet fisheries capture lake whitefish in both the Wisconsin waters of Lake Michigan and Green Bay, whereas the Wisconsin state-licensed bottom trawl fishery captures lake whitefish only in the Wisconsin waters of Lake Michigan. Abundance for lake whitefish was scored a low concern in all three Wisconsin fisheries, because data-limited assessments illustrate that abundance is either above, at, or at least 75% of the established target reference point, and fishing mortality was scored a low concern, because it is below the target reference point. The bycatch strategy in the Wisconsin fisheries was scored highly effective because the gear used are highly selective, so no additional main species were included. For all three Wisconsin fisheries, management strategy and implementation was scored highly effective, because more than 70% of the fishery's main targeted and retained stocks have effective and appropriate management targets defined, and precautionary policies are in place that are based on scientific advice. Ecosystem-based fisheries management was scored a low concern for all Wisconsin fisheries, because harvest control rules and spatial and temporal closures are in place to protect the stock, but detrimental food web impacts from harvesting the species are unlikely but still possible. Taken together, lake whitefish in the Wisconsin state-licensed trap net, large-mesh gillnet, and bottom trawl fisheries receive a Green rating.

The Michigan state-licensed trap net fishery captures lake whitefish in the Michigan waters of Lake Michigan. Abundance was scored a low concern, because recent stock assessments and current metrics indicate a healthy population and more than 70% of the stocks are above the target reference point. Fishing mortality was also scored a low concern, because more than 70% of the stocks are below the target reference point in their respective management units. The bycatch strategy in the Michigan state-licensed trap net fishery was scored highly effective, because the gear used is highly selective, so no additional main species were included. Management strategy and implementation was scored highly effective, because more than 70% of the fishery's main targeted and retained stocks have effective and appropriate management targets defined, and precautionary policies are in place that are based on scientific advice. Ecosystem-based fisheries management was scored a low concern, because harvest control rules and spatial and temporal closures are in place to protect the stock, but detrimental food web impacts from harvesting the species are unlikely but still possible. Taken together, lake whitefish in the Michigan state-licensed trap net fishery receive a Green rating.

Tribal-licensed fishers use both trap nets and large-mesh gillnets to harvest lake whitefish, lake trout, and walleye in 1836 Treaty-ceded Michigan waters of Lake Michigan. Abundance was scored a low concern for lake whitefish, because more than 70% of the stocks are above the target reference point, and fishing mortality was scored a low concern, because it is below the target reference point in more than 70% of the stocks. Because abundance of lake trout in all management units is either above or at least 75% of the established target reference point, it was scored a low concern. The fishing mortality of lake trout is greater than 50% but less than 70% and all management units are below the target reference point, so fishing mortality was scored a moderate concern. There are no quantitative stock assessments or data-limited assessments conducted for walleye in Michigan waters of Lake Michigan, so abundance was scored a

moderate concern using the productivity/susceptibility analysis (PSA). Also, because there are no available reference points to determine whether fishing mortality is at an appropriate level for walleye, it was scored a moderate concern. The bycatch strategy in the Michigan tribal-licensed trap net and large-mesh gillnet fisheries was scored highly effective because the gear used are highly selective, so no additional main species were included. More than 70% of the fishery's main targeted and retained stocks have measures in place that are expected to be effective, but there is a potential need for increased precaution, so management strategy and implementation was scored moderately effective. Ecosystem-based fisheries management was scored a moderate concern, because neither harvest control rules nor harvest regulation guidelines have been established for all species captured, and there is a lack of temporal and spatial management strategies to protect ecosystem functioning for all capture species in the Michigan tribal-licensed trap net and large-mesh gillnet fisheries. Taken together, lake whitefish and lake trout in the Michigan tribal-licensed trap net and large-mesh gillnet fisheries receive a Green rating, and walleye in the Michigan tribal-licensed trap net and large-mesh gillnet fisheries receive a Yellow rating.

Final Seafood Recommendations

SPECIES FISHERY	C 1	C 2	C 3	C 4	OVERALL	VOLUME (MT) YEAR
	TARGET SPECIES	OTHER SPECIES	MANAGEMENT	HABITAT		
Lake trout Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	3.318	4.284	3.000	3.000	Best Choice (3.363)	Unknown
Lake trout Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	3.318	4.284	3.000	3.000	Best Choice (3.363)	Unknown
Lake whitefish Lake Michigan America, North - Inland Waters United States Wisconsin Bottom trawls	4.284	5.000	5.000	2.828	Best Choice (4.172)	Unknown
Lake whitefish Lake Michigan America, North - Inland Waters United States Wisconsin Set gillnets	4.284	5.000	4.000	3.464	Best Choice (4.151)	Unknown
Lake whitefish Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	4.284	3.318	3.000	3.000	Best Choice (3.363)	Unknown
Lake whitefish Lake Michigan America, North - Inland Waters United States Wisconsin Stationary uncovered pound nets	4.284	5.000	4.000	3.464	Best Choice (4.151)	Unknown
Lake whitefish Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets	4.284	5.000	4.000	3.464	Best Choice (4.151)	Unknown
Lake whitefish Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	4.284	5.000	3.000	3.000	Best Choice (3.726)	Unknown
Walleye Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	2.644	3.318	3.000	3.000	Good Alternative (2.981)	Unknown
Walleye Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	2.644	5.000	3.000	3.000	Good Alternative (3.303)	Unknown

Production volumes by specific gear type are not available for all fisheries in Lake Michigan.

In 2020, approximately 971.38 MT of lake whitefish were harvested by the Lake Michigan commercial fisheries (288.56 MT by the Michigan state-licensed trap net fishery; 186.06 MT by the CORA tribal-licensed trap net and gillnet fisheries; 496.77 MT by the Wisconsin state-licensed trap net, gillnet, and bottom trawl fisheries) (GLFC 2022b). In 2020, approximately 239.25 MT of lake trout were harvested by Lake Michigan

commercial fisheries (CORA tribal-licensed trap net and gillnet fisheries) (GLFC 2022b). In 2020, approximately 1.89 MT of walleye were harvested by Lake Michigan commercial fisheries (CORA tribal-licensed trap net and gillnet fisheries) (GLFC 2022b).

Of the commercial fishery production in Lake Michigan, approximately 100% of the lake whitefish are rated Green, approximately 100% of the lake trout are rated Green, and approximately 100% of the walleye are rated Yellow.

Summary

Lake whitefish (*Coregonus clupeaformis*) harvested in Lake Michigan by the Wisconsin state-licensed trap net (stationary uncovered pound net), gillnet, and bottom trawl fisheries, the Michigan state-licensed trap net (stationary uncovered pound net) fishery, and the Michigan tribal-licensed trap net (stationary uncovered pound net) and gillnet fisheries are rated Green.

Lake trout (*Salvelinus namaycush*) harvested in Lake Michigan by the Michigan tribal-licensed trap net (stationary uncovered pound net) and gillnet fisheries are rated Green.

Walleye (*Sander vitreus*) harvested in Lake Michigan by the Michigan tribal-licensed trap net (stationary uncovered pound net) and gillnet fisheries are rated Yellow.

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

Best Choice/Green = Final Score >3.2, and no Red Criteria, and no Critical scores

Good Alternative/Yellow = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern², and no more than one Red Criterion, and no Critical scores

Avoid/Red = Final Score \leq 2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

² Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

Introduction

Scope of the analysis and ensuing recommendation

This report evaluates the commercial harvest of lake whitefish (*Coregonus clupeaformis*), lake trout (*Salvelinus namaycush*), and walleye (*Sander vitreus*) in the waters of Lake Michigan (including Green Bay), which encompasses both state-licensed fisheries (Michigan and Wisconsin) and tribal-licensed fisheries (Michigan). Data from the Chippewa Ottawa Resource Authority (CORA) tribal-licensed commercial fishery represent the production by tribal members licensed by the Sault Ste. Marie Tribe of Chippewa Indians, Bay Mills Indian Community, Grand Traverse Band of Ottawa and Chippewa Indians, Little Traverse Bay Bands of Odawa Indians, and the Little River Band of Ottawa Indians tribal governments (GLFC 2022a). There was no reported commercial fishery production from the Illinois or Indiana waters of Lake Michigan during 2013–20, so Illinois and Indiana were not included in this report (GLFC 2022a)(GLFC 2022b).

In Lake Michigan, walleye and lake trout are caught with stationary uncovered pound nets (henceforth trap nets) and large-mesh gillnets solely by the CORA tribal-licensed fishery, because there is no state-licensed commercial fishery for walleye or lake trout in the Michigan or Wisconsin waters of Lake Michigan. Lake whitefish is caught with large-mesh gillnets, trap nets, and bottom trawls by the Wisconsin state-licensed fishery, by trap nets in the Michigan state-licensed fishery, and by large-mesh gillnets and trap nets in the CORA tribal-licensed fishery.

Species Overview

Lake trout is a temperate (4–13 °C) freshwater salmonid distributed in the northern parts of North America throughout Canada as well as Alaska and the Laurentian Great Lakes in the United States (Froese and Pauly 2023c). It can be found in depths to 61 m, but is usually found in waters 18–53 m deep (Froese and Pauly 2023c). Lake trout can reach 150 cm total length (TL) (common 50 TL) and 32.7 kg total weight, and the maximum reported age is 50 years (Froese and Pauly 2023c). It is a broadcast spawner that reaches reproductive maturity at 42–50 cm (Froese and Pauly 2023c). Adults feed primarily on crustaceans, insects, and fishes, but will also eat small mammals and plankton throughout their lives (Froese and Pauly 2023c). Specific to the Great Lakes, lake trout weigh an average of 4–5 kg and their lifespan may exceed 25 years (MDNR 2024a).

Lake whitefish is a temperate (8–14 °C) freshwater and brackish salmonid distributed in North America throughout Canada as well as Alaska, New England, the Laurentian Great Lakes, and central Minnesota in the United States (Froese and Pauly 2023b). It can be found in waters ranging from 8 to 128 m deep (Froese and Pauly 2023b). Lake whitefish can reach 100 cm TL (commonly 54.1 cm TL) and 19 kg total weight, and the maximum reported age is 50 years (Froese and Pauly 2023b). It is an annual open water/substratum egg scatterer in the southern portion of its range, but reproduces every 2 to 3 years in the northern sub-Arctic and Arctic regions (Froese and Pauly 2023b). Adults feed on aquatic insect larvae, mollusks, amphipods, fishes, and fish eggs (Froese and Pauly 2023b). Specific to the Great Lakes, lake whitefish can reach a lifespan of over 25 years and a weight of more than 9 kgs, and has a common size of 43–55 cm in the commercial fishery (MDNR 2024b)(Michigan Sea Grant 2024).

Walleye is a subtropical (1–29 °C) freshwater and brackish perciform fish that is present in the Laurentian Great Lakes, Arctic, and Mississippi River basins in North America (Froese and Pauly 2023a). Its distribution ranges from Quebec to the Northwest Territories in Canada, and south to Alabama and Arkansas in the United States (Froese and Pauly 2023a). It can be found in waters ranging from 0 to 27 m deep (Froese and

Pauly 2023a). Walleye can reach 107 cm full length (commonly 57 cm TL) and 11.3 kg total weight, and the maximum reported age is 29 years (Froese and Pauly 2023a). It is a broadcast spawner that reaches reproductive maturity at 36–44.8 cm (Froese and Pauly 2023a). Specific to the Great Lakes, females mature at around 3–6 years and males mature at around 2–4 years (MDNR 2024c). Adults feed primarily on insects and fishes, but will also consume crayfish, snails, frogs, mudpuppies, and small mammals (Froese and Pauly 2023a).

There are several management bodies that manage the fisheries in Lake Michigan, including state, federal, and tribal bodies: the Chippewa-Ottawa Resource Authority (CORA), the Illinois Department of Natural Resources, the Indiana Department of Natural Resources, the Michigan Department of Natural Resources, and the Wisconsin Department of Natural Resources. Also, the Great Lakes Fishery Commission promotes collaborative fishery management among the aforementioned agencies, aiding them in reaching consensus-based decisions for effective management as described in the Joint Strategic Plan for Management of Great Lakes Fisheries, which was originally enacted in 1981 (GLFC 2007). The Plan was reviewed in 1986 and amended in 1997 in an effort to adopt practices to better coordinate fishery and environmental management issues. During this time, members and representatives from CORA and the United States Geological Survey were offered seats on the Council of Lake Committees (GLFC 2007). For further information on the underlying management body for each Lake Michigan fishery assessed in this report, refer to the Criterion 3 Summary.

Production Statistics

In Lake Michigan, the commercial fish production from 2016 to 2020 for lake trout, lake whitefish, and walleye totaled approximately 1,375 MT, 6,195 MT, and 12 MT, respectively (Figure 1) (GLFC 2022b). From 2016 to 2020, the CORA tribal-licensed fishery harvested approximately 1,375 MT of lake trout, 1,562 MT of lake whitefish, and 12 MT of walleye (Figure 1) (GLFC 2022b). The Michigan state-licensed fishery harvested approximately 1,676 MT of lake whitefish and the Wisconsin state-licensed fishery harvested 2,956 MT of lake whitefish from 2016 to 2020 (Figure 1) (GLFC 2022b). Commercial production data were obtained directly from each applicable state and Native American natural resource agency (Chippewa Ottawa Resource Authority) (GLFC 2022a).

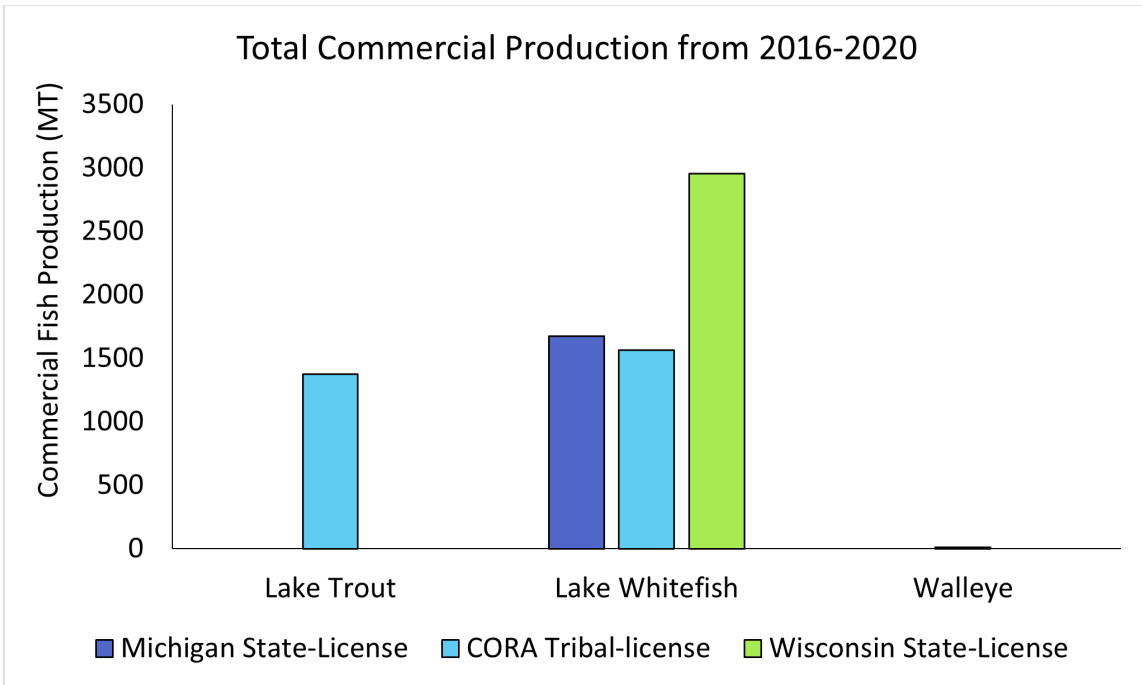


Figure 1: Commercial fish (lake trout, lake whitefish, and walleye) production (MT) in Lake Michigan harvested by the Michigan state-licensed fishery (dark blue), the CORA tribal-licensed fishery (light blue), and the Wisconsin state-licensed fishery (green) (GLFC 2022b).

Lake Trout

Lake trout was extirpated from Lake Michigan by the 1950s as the result of overfishing and sea lamprey predation; however, the population has been sustained primarily through stocking and various lake-wide management efforts (GLFC 2021). Commercial harvest of lake trout in Lake Michigan has fluctuated historically, peaking in 1999 (Figure 2) (GLFC 2023b). In 2020, approximately 239.25 MT of lake trout were harvested by Lake Michigan commercial fisheries (CORA tribal-licensed trap net and gillnet fisheries) (Figure 2) (GLFC 2022b).

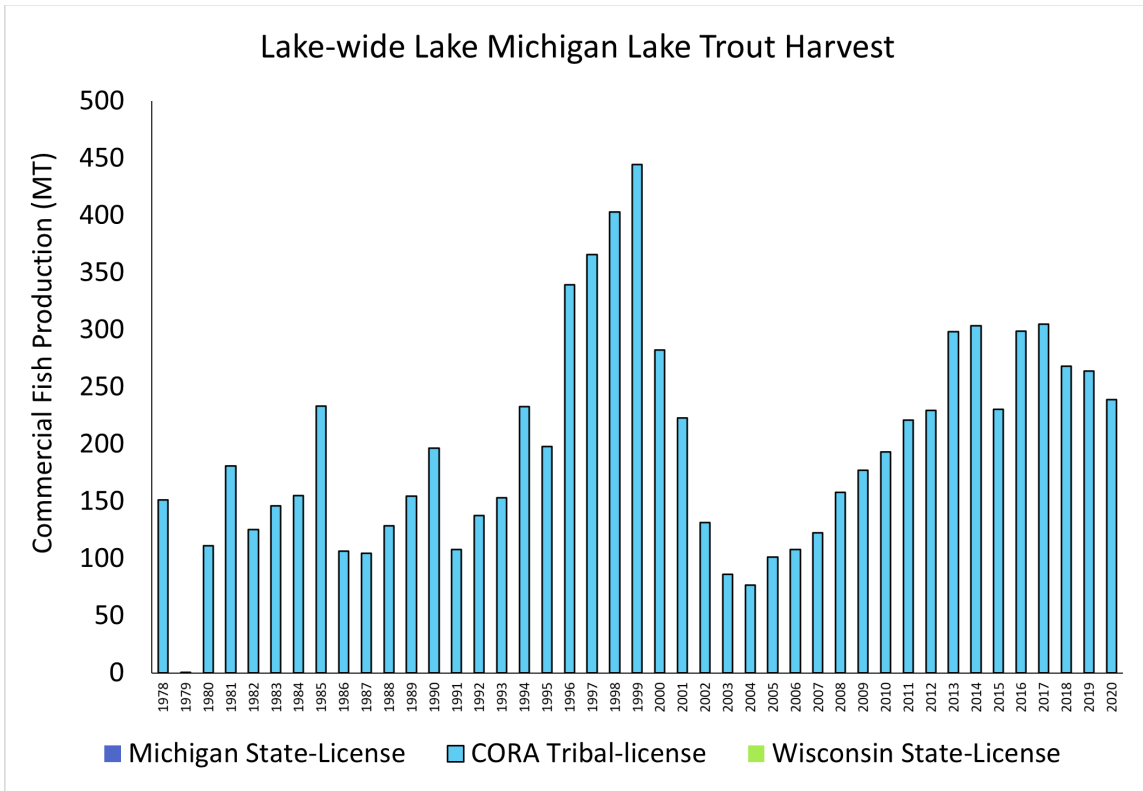


Figure 2: Lake Michigan lake trout harvest from 1978 to 2020 by the Michigan state-licensed fishery (dark blue), the CORA tribal-licensed fishery (light blue), and the Wisconsin state-licensed fishery (green) (GLFC 2022b).

Lake Whitefish

Lake whitefish commercial harvest in Lake Michigan has fluctuated historically; however, it has been steadily declining since 2012 (Figure 3) (GLFC 2023b). In 2020, approximately 971.38 MT of lake whitefish were harvested by Lake Michigan commercial fisheries (288.56 MT by the Michigan state-licensed trap net fishery; 186.06 MT by the CORA tribal-licensed trap net and gillnet fisheries; 496.77 MT by the Wisconsin state-licensed trap net, gillnet, and bottom trawl fisheries) (Figure 3) (GLFC 2022b).

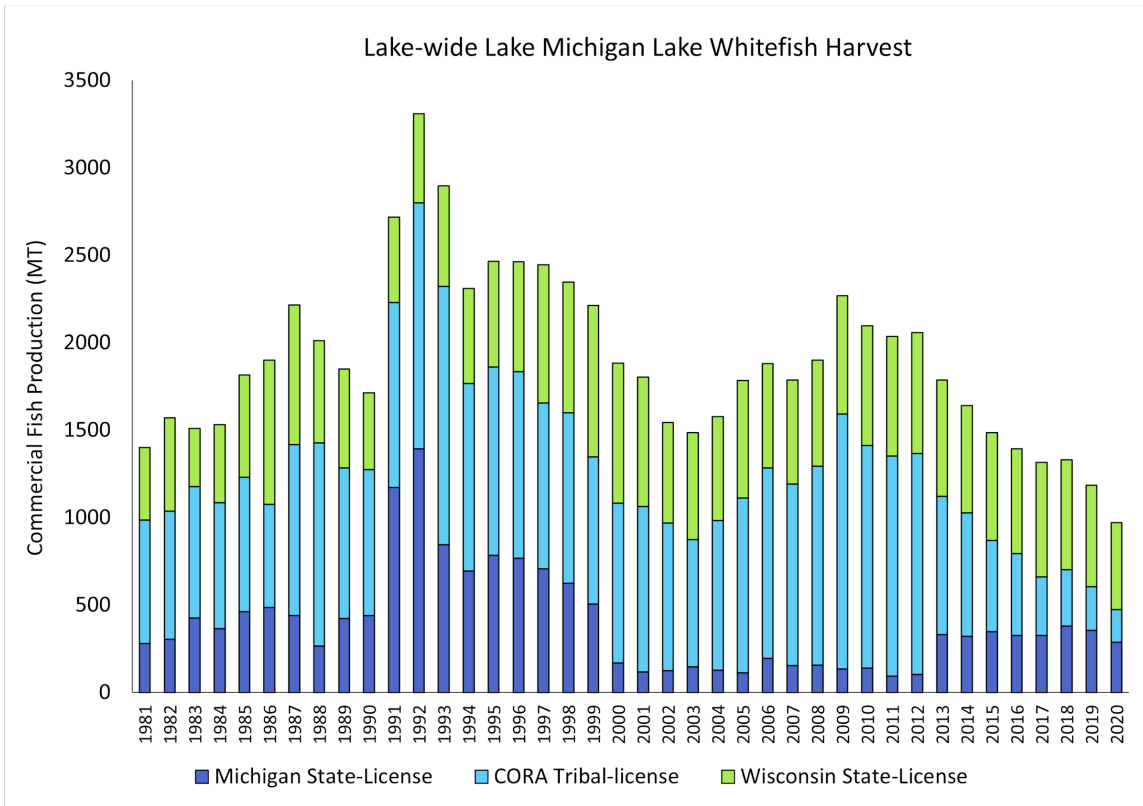


Figure 3: Lake Michigan lake whitefish harvest from 2016 to 2020 by the Michigan state-licensed fishery (dark blue), the CORA tribal-licensed fishery (light blue), and the Wisconsin state-licensed fishery (green) (GLFC 2022b).

In 2021, the commercial harvest of lake whitefish in Wisconsin waters of Lake Michigan was the lowest since the quotas were established in 1989–90 (Figure 4) (WDNR 2022a). In the Wisconsin waters of Lake Michigan, trap nets and gillnets have been the primary gears used to harvest lake whitefish; however, a new fishery (bottom trawl) emerged in 2019 that is restricted to only the Manitowoc/Two Rivers area of Lake Michigan (WDNR 2022a). The Wisconsin lake whitefish bottom trawl fishery was implemented to increase the effectiveness and flexibility of the harvest to a more year-round fishery with low bycatch (<3%) (Seilheimer 2019). Trap net catch per unit effort (CPUE) has steadily declined in recent years, whereas gillnet CPUE has remained stable over the past 15–20 years (Figure 5). The overall decline in CPUE for all gears potentially suggests a decline in the lake whitefish population in Wisconsin waters (WDNR 2022a).

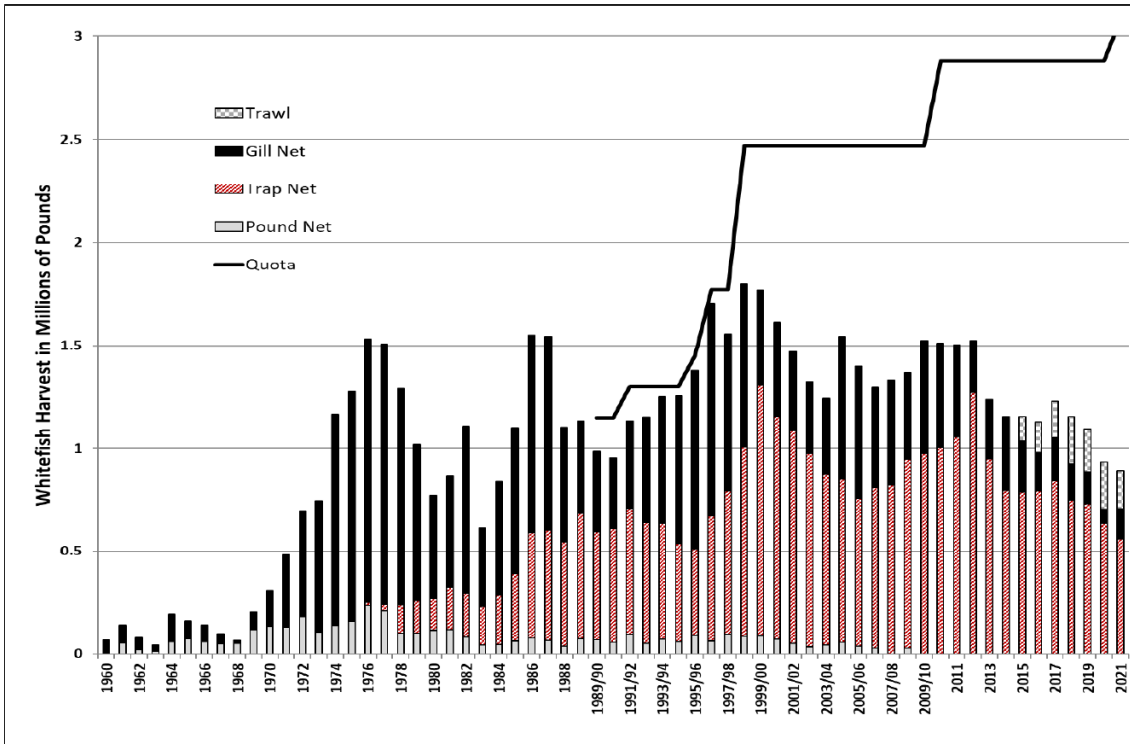


Figure 4: Lake whitefish reported commercial harvest by gear in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay, from 1960 through 2021. (Calendar years 1949 through 1989 and 2010–21; quota years 1989–90 through 2008–09). Years in which there was a transition (1989, 2010) are reported both in quota and calendar year harvest (WDNR 2022a).

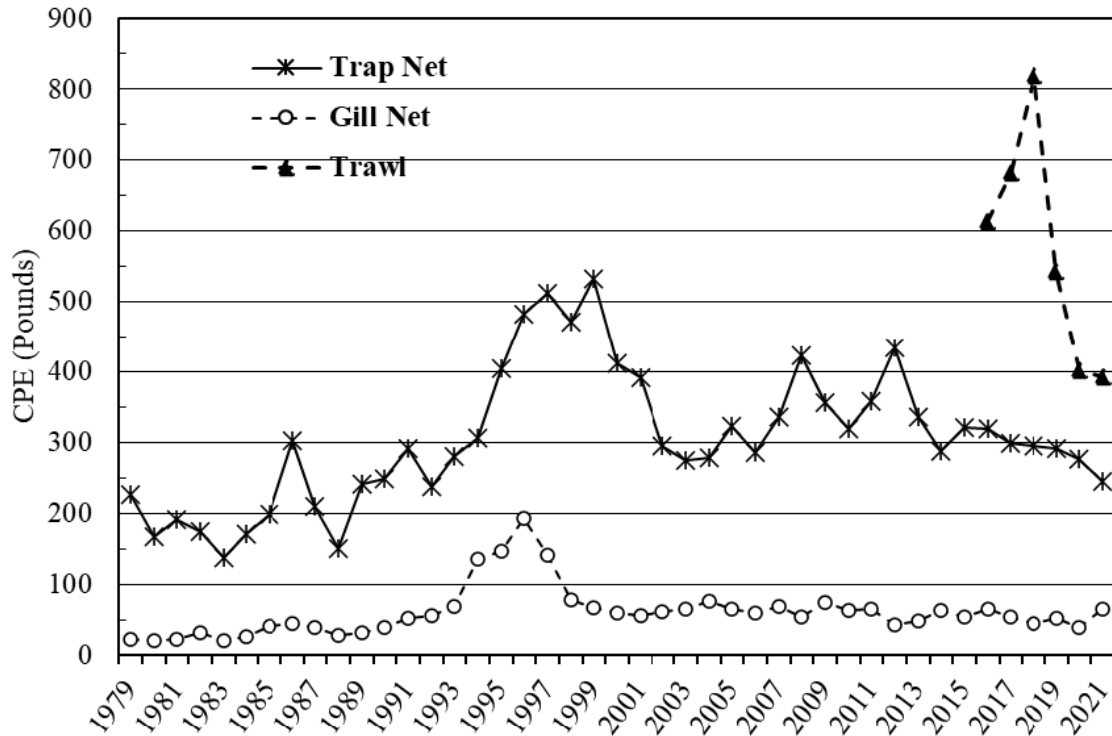


Figure 5: Trends in commercial dressed weight catch per unit of effort (CPUE) for Lake whitefish in Wisconsin waters of Lake Michigan, including Green Bay, 1979–2021. Gill net is in pounds harvested per 1,000 feet lifted, trap net is in pounds harvested per pot lifted, and trawl is in pounds harvested per hour fished. The first three years of data from the trawl fishery should be interpreted with caution because they were part of an experimental study (WDNR 2022a).

Walleye

Historically, the average commercial harvest of walleye has been approximately 3.6 MT per year (from 2000 to 2020) (GLFC 2022b). Abundance has been high enough in most years to allow for harvest levels to be within the established fish community objective range (GLFC 2021). In 2020, approximately 1.89 MT of walleye were harvested by Lake Michigan commercial fisheries (CORA tribal-licensed trap net and gillnet fisheries) (Figure 6) (GLFC 2022b).

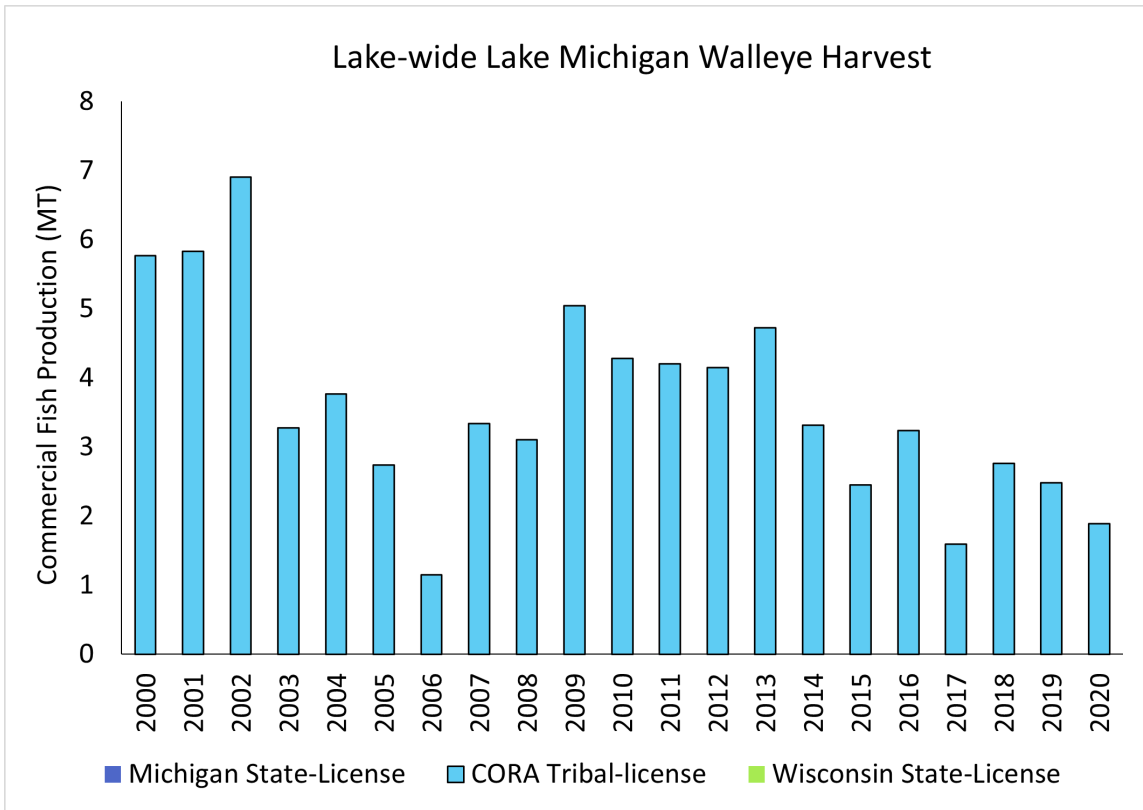


Figure 6: Lake Michigan walleye harvest from 2016 to 2020 by the Michigan state-licensed fishery (dark blue), the CORA tribal-licensed fishery (light blue), and the Wisconsin state-licensed fishery (green) (GLFC 2022b).

Importance to the US/North American market.

None of the species evaluated in this report are considered important from the perspective of global trade (Jescovitch et al. 2022). The majority of fish harvested in the Great Lakes region are sold in the local market (within 60 miles) either as fish (46.5%) or processed product (68%), which may include value-added items such as fillets, smoking, and fish dips (Jescovitch et al. 2022). A lower percentage of fish harvested in the Great Lakes region is sold regionally, at 37.9% and 25.4% for fish and processed products, and nationally, at 12.7% and 5.1%, respectively (Jescovitch et al. 2022). Only small proportions—2.9% for fish and 1.5% for processed product—are sold in international markets (Jescovitch et al. 2022).

Common and market names.

Lake trout (*Salvelinus namaycush*) is also known as Great Lakes trout, laker, namaycush, togue, namegos (The Ojibwe People's Dictionary 2021), grey trout, mountain trout, mackinaw, lake char/charr, touladi, and salmon trout.

Walleye (*Sander vitreus*) is also known as yellow pickerel, pickerel (Canada), yellow pike, ogaa (The Ojibwe People's Dictionary 2021), yellow walleye, and dore (France, Canada).

Lake whitefish (*Coregonus clupeaformis*) is also known as common whitefish, Sault whitefish, whitefish, adikameg (The Ojibwe People's Dictionary 2021), eastern whitefish, Great Lakes whitefish, inland whitefish, gizzard fish, grande coregone (French), and Attikumaig (Chippewa).

Primary product forms

Lake trout may be marketed as fresh, frozen, or smoked, or as whole dressed fish.

Walleye is available fresh as whole fish (head on or off, dressed) or fillets (skin on or off), and frozen as fillets or fingers (7–12 cm strips).

Lake whitefish is available fresh or frozen as whole dressed fish or fillets. New value-added products growing in market share include frozen vacuum-packed fillets and prepared foods such as spreads. Lake whitefish roe is also marketed as “golden caviar” or “sikrom.”

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level*

Criterion 1 Summary

LAKE TROUT			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)

LAKE WHITEFISH			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Michigan America, North - Inland Waters United States Wisconsin Bottom trawls	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Lake Michigan America, North - Inland Waters United States Wisconsin Set gillnets	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Lake Michigan America, North - Inland Waters United States Wisconsin Stationary uncovered pound nets	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	3.670: Low Concern	5.000: Low Concern	Green (4.284)

WALLEYE			
REGION / METHOD	ABUNDANCE	FISHING MORTALITY	SCORE
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

Criterion 1 Assessments

SCORING GUIDELINES

Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- 5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.
- 3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.
- 2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.
- 1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.

Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

Lake trout (*Salvelinus namaycush*)

Factor 1.1 - Abundance

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Low Concern

The most recent data-limited stock assessment for lake trout in the Michigan waters of Lake Michigan was conducted in 2022 (MSC 2022). Lake trout stocks are divided into seven spatially explicit management units in the Michigan waters of Lake Michigan, and each unit abides by the 2023 Great Lakes Decree provisions that are either partly or wholly contained within the 1836 Treaty-ceded waters of Lake Michigan (MSC 2022)(United States v. Michigan 2023). Stock assessment models utilize both fishery-independent and fishery-dependent information, and some management units have been combined for stock assessment purposes (e.g., MM-123 and MM-67) (MSC 2022). The total biomass and female biomass estimates for each management unit are shown in Figures 7–10 (see Justification). The current spawning stock biomass per recruit (SSBR) in all management units was either above SSBR at target mortality or above 75% of SSBR at target mortality, depending on which management unit was assessed (MM-123—current: 0.73 lb, target: 0.76 lb) (MM-4—current: 0.38 lb, target: 0.38 lb) (MM-5—current: 0.82 lb, target: 0.39 lb) (MM-67—current: 1.47 lb, target: 0.76 lb) (MSC 2022). In addition, the current spawning per recruit (SPRs) for MM-123, MM-4, MM-5, and MM-67 were 0.28, 0.22, 0.47, and 0.52, respectively (MSC 2022). Natural reproduction continues to increase in Lake Michigan, although high levels of stocking continue to sustain populations in most units. Further, the management body notes that, although lake trout populations are in a much more favorable position than when previously assessed in the 2010s, they still heavily rely on stocking to sustain the populations, and there is still minimal, yet increased, natural reproduction (MSC 2022)(LMLTWG 2021). Recruitment of wild fish has increased in four of the seven management units (MM-6, MM-7, MM-5, and MM-4), but has remained low in three of the seven management units (MM-1, MM-2, and MM-3) (MSC 2022)(LMLTWG 2021).

Because data-limited assessments are available and abundance in all management units is either above the target reference point or at least 75% of the target reference point, per the Seafood Watch Standard for Fisheries, this factor has been collectively scored a low concern.

Justification:

In the first three lake trout management units (MM-1, MM-2, and MM-3), yields have been steady since 2013, and the increases in lake trout abundance in these areas are likely the result of a reduction in sea lamprey-induced mortality over the last few years (Figure 7) (MSC 2022).

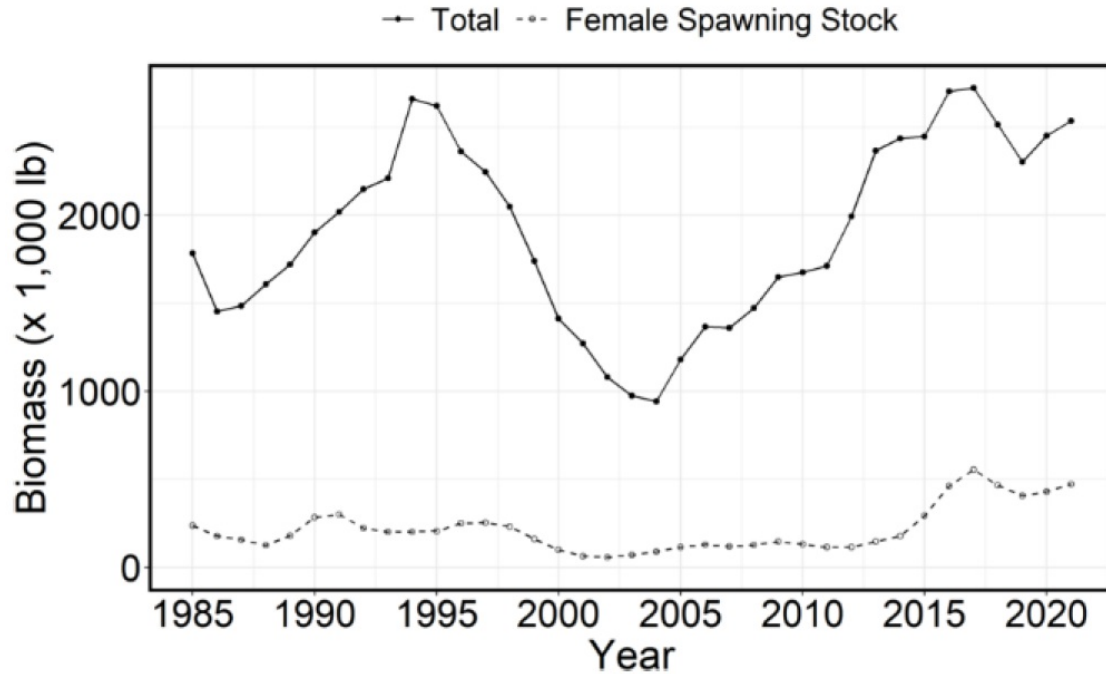


Figure 7: Estimated lake trout biomass in MM-123 (MSC 2022).

In the fourth management unit (MM-4), yields have been fairly stable since 2011, and increased stocking through the mid-2000s combined with a decrease in sea lamprey-induced mortality has contributed to a stable population size through the 2010s (Figure 8) (MSC 2022). But this population is mostly immature fish, and recruitment of wild fish is nearly nonexistent, although it has increased over the last two years. Also, decreases in stocking levels during 2020 and 2021 because of COVID-related issues are likely to result in lower recruitment in the upcoming years (MSC 2022).

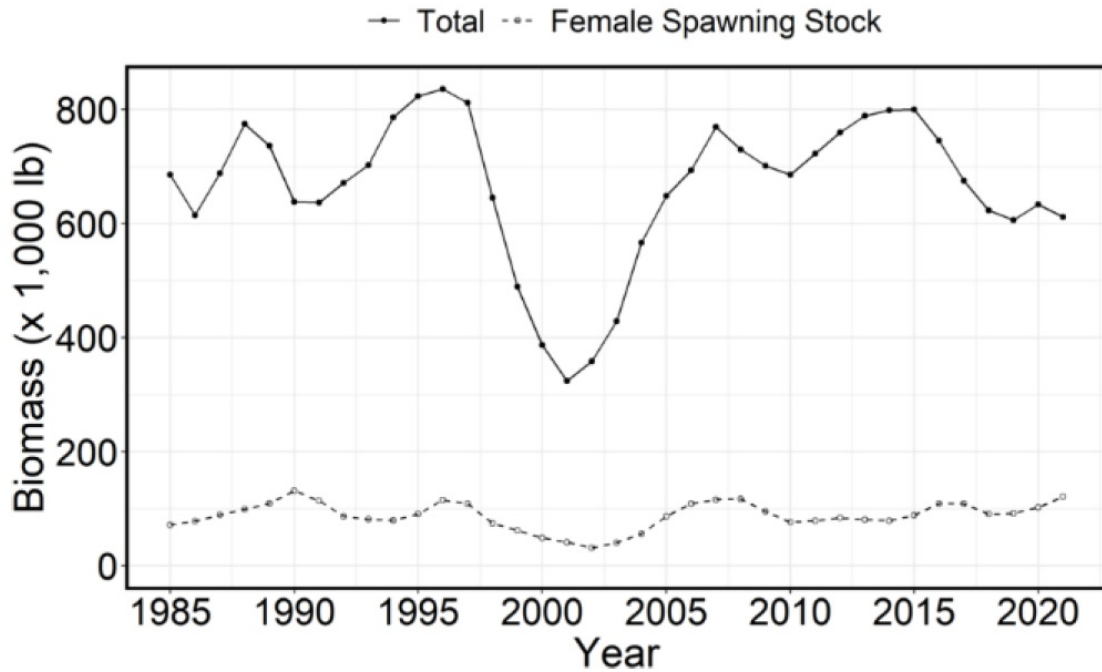


Figure 8: Estimated lake trout biomass in MM-4 (MSC 2022).

In the fifth management unit (MM-5), yield has fluctuated in recent years and survey estimates are less clear. Spawning biomass has increased $\approx 50\%$ since 2014, which is mainly driven by the increased maturity in younger fish (Figure 9) (MSC 2022). There is uncertainty whether this population has increased due to issues regarding increased stocking effects and changes in catchability; however, since 2015, wild fish recruitment has increased in this area, but this stock assessment remains highly uncertain from ambiguity in scaling and model assumptions (MSC 2022). In addition, similar to other management units, decreased stocking levels in this fifth management unit during 2020–21 because of COVID-related issues are likely to result in lower recruitment in upcoming years (MSC 2022).

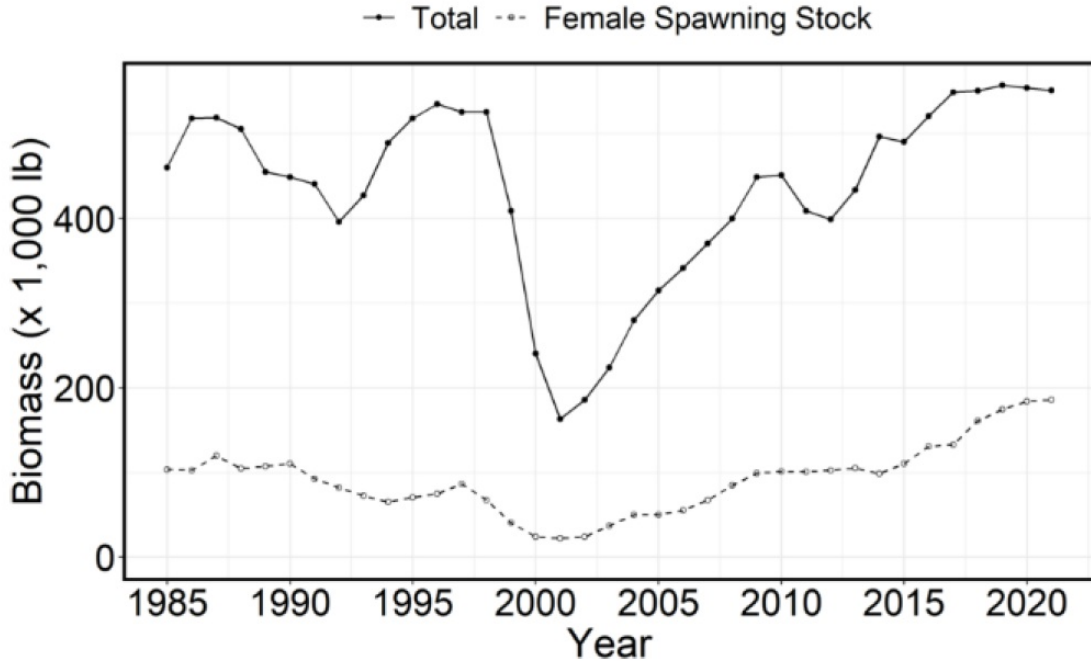


Figure 9: Estimated lake trout biomass in MM-5 (MSC 2022).

Trends in the remaining two management units (MM-6 and MM-7) are like those seen in the fifth management unit (MM-5), although model estimates have less uncertainty because of an increase of sampling in these areas (Figure 10) (MSC 2022). Reduced stocking as a result of COVID-related issues is potentially particularly impactful in these two units, because it is coupled with previous stocking reductions that began in 2017, and it is unknown if the increase in wild recruitment will offset this reduction in the upcoming years (MSC 2022).

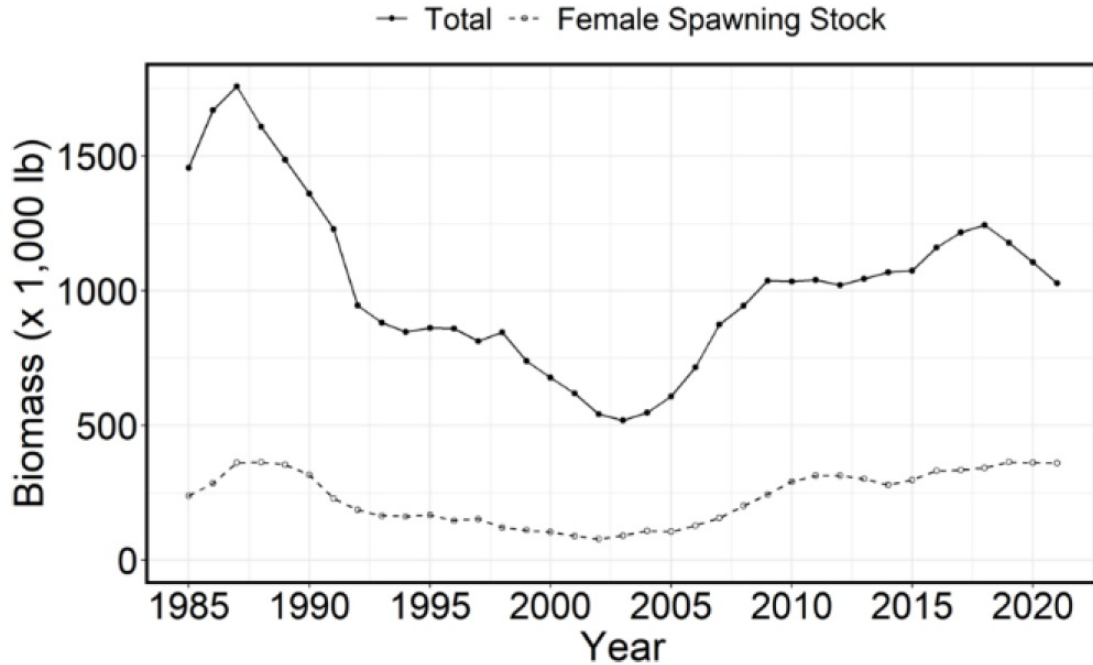


Figure 10: Estimated lake trout biomass in MM-67 (MSC 2022).

Factor 1.2 - Fishing Mortality

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
 Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Moderate Concern

The most recent data-limited stock assessment from 2022 conducted in Michigan waters of Lake Michigan for lake trout indicated that commercial fishing mortality (averaged from 2019-2021) was 0.23/y for MM-123, 0.20/y for MM-4, 0.02/y for MM-5, and <0.01/y for MM-67 (MSC 2022). The 2021 total mortality (Z) estimates for MM-123, MM-4, MM-5, and MM-67 were 0.53/y, 0.61/y, 0.41/y, and 0.37/y, respectively (ibid). Mortality was above the target rate in MM-123 and MM-4, and has been above target reference point for almost every year of the previous 2000 Consent Decree (Figures 11 and 12) (MSC 2022). However, mortality was below the target rate in MM-5 and MM-6 (see Figures 13 and 14) (MSC 2022). Therefore, as greater than 50%, but less than 70%, of all management units are below the target reference point, fishing mortality has been collectively scored as a "moderate concern."

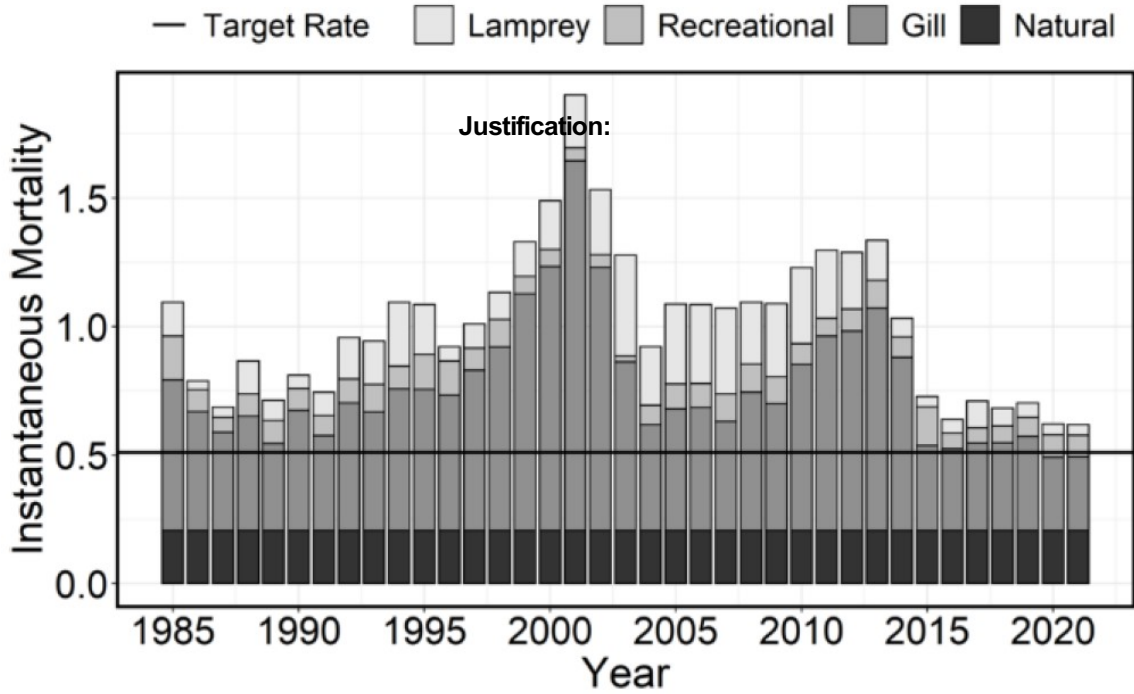


Figure 11: Maximum mortality rates for lake trout in MM-123 (MSC 2022).

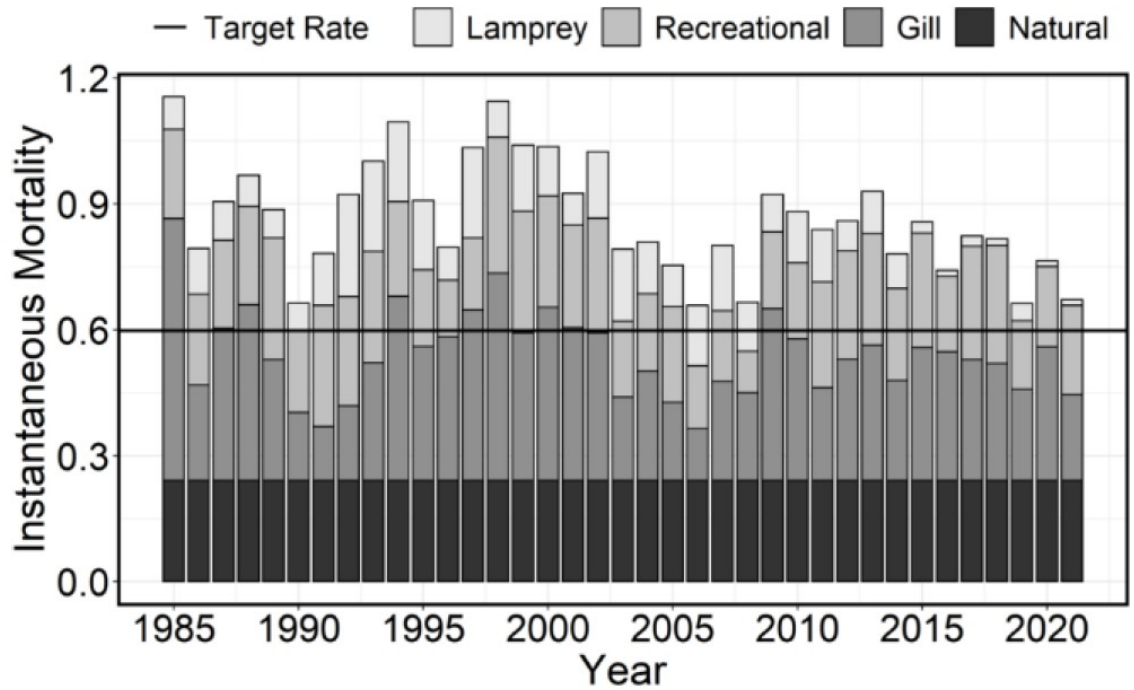


Figure 12: Maximum mortality rates for lake trout in MM-4 (MSC 2022).

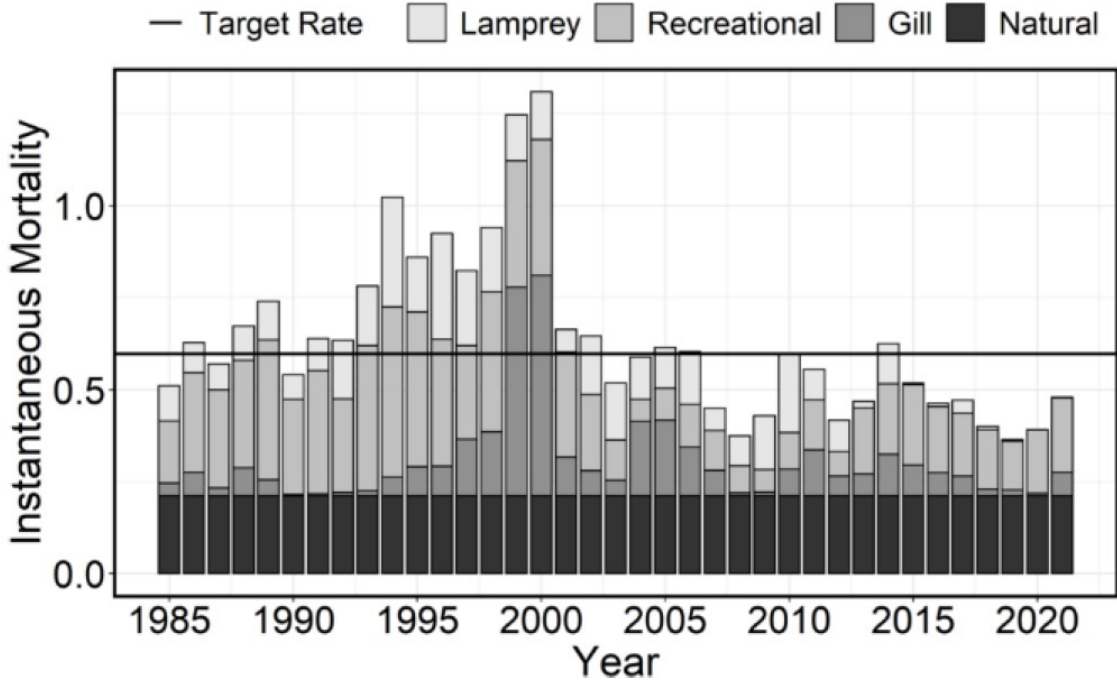


Figure 13: Maximum mortality rates for lake trout in MM-5 (MSC 2022).

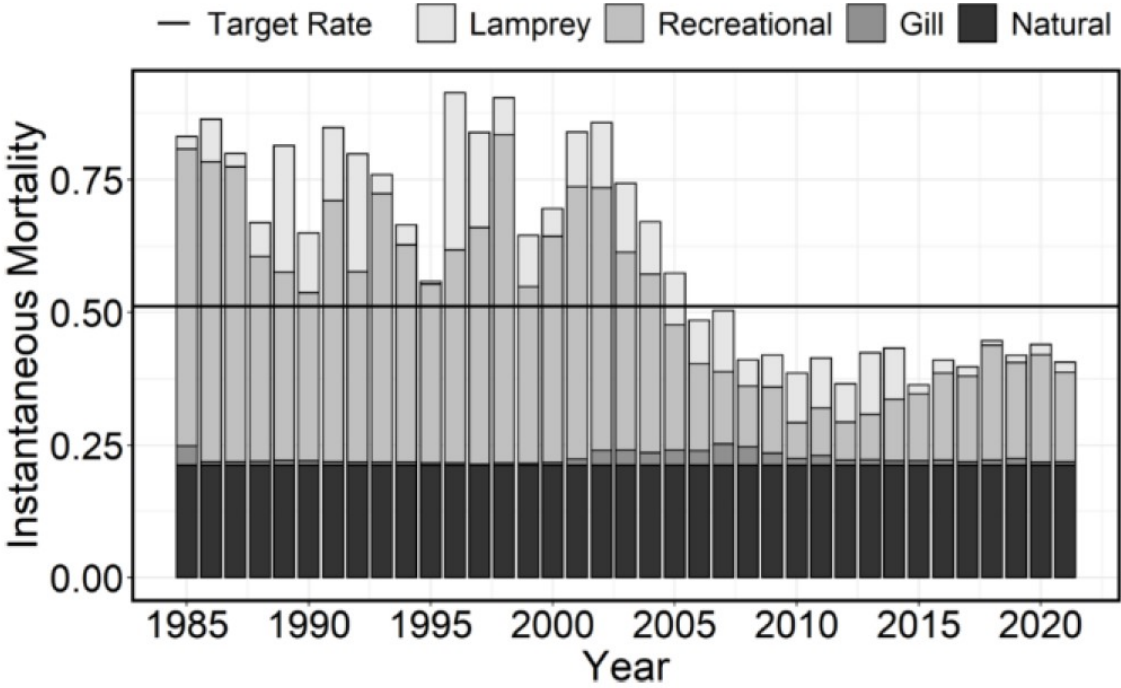


Figure 14: Maximum mortality rates for lake trout in MM-67 (MSC 2022).

Lake whitefish (*Coregonus clupeaformis*)

Factor 1.1 - Abundance

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Low Concern

The most recent data-limited stock assessment for lake whitefish in the Michigan waters of Lake Michigan was conducted in 2022 (MSC 2022). Lake whitefish is divided into eight spatially explicit management units in the Michigan waters of Lake Michigan, and each unit abides by the 2023 Great Lakes Decree provisions that are either partly or wholly contained within the 1836 Treaty-ceded waters of Lake Michigan (MSC 2022)(United States v. Michigan 2023). Lake whitefish stock assessment models utilize only fishery-dependent information from the commercial fisheries, and the best available data and consistent model structures and procedures are used across all management units to estimate stock metrics (MSC 2022).

The total biomass and female biomass estimates for each management unit are shown in Figures 15–21 (see Justification). Current SSBRs in all applicable units are above the SSBRs at target mortality (WFM-01—current: 1.62 lb, target: 0.6 lb) (WFM-02—current: 2.21 lb, target: 0.61 lb) (WFM-03—current: 1.86 lb, target: 1.06 lb) (WFM-04—current: 2.88 lb, target: 0.62 lb) (WFM-05—current: 2.92 lb, target: 0.45 lb) (WFM-06—current: 2.835 lb, target: 0.79 lb) (WFM-07—does not have a stock assessment) (WFM-08—current: 2.94 lb, target: 0.61 lb) (MSC 2022). There is a complementary rule set by the Modeling Subcommittee and Technical Fisheries Committee that reduces mortality below the target rate in the next fishing season if the SPR is below 0.2; hence, an SPR of 0.2 may be considered the limit level (MSC 2022). But this complementary rule was part of the 2000 Decree and is no longer in use as part of the 2023 Decree. Also, the current SPRs for WFM-01, WFM-02, WFM-03, WFM-04, WFM-05, WFM-06, and WFM-08 were 0.50, 0.66, 0.57, 0.84, 0.76, 0.64, and 0.69, respectively (MSC 2022). Overall patterns in recruitment and biomass are similar throughout all management units and have declined over the past few years. Specifically, from 2012 to present, there has been a decline in catch rates and effort that has affected fishery yields. This is compounded by a decrease in recruitment, which has resulted in a continued loss of the fishable stock (MSC 2022).

Because data-limited assessments are available for this population and current metrics indicate healthy populations (more than 70% of the stocks are above the target reference point), per the Seafood Watch Standard for Fisheries, abundance has been collectively scored a low concern for lake whitefish in Michigan waters of Lake Michigan.

Justification:

In the first lake whitefish management unit (WFM-01), yield and catch rates were the lowest in the model time series in 2020 (Figure 15) (MSC 2022). Also, effort in 2020 was similar to early- to mid-2000s levels, suggesting negative consequences caused by the pandemic and/or that the decline in catches affected the fishery's operations in the management unit (MSC 2022).

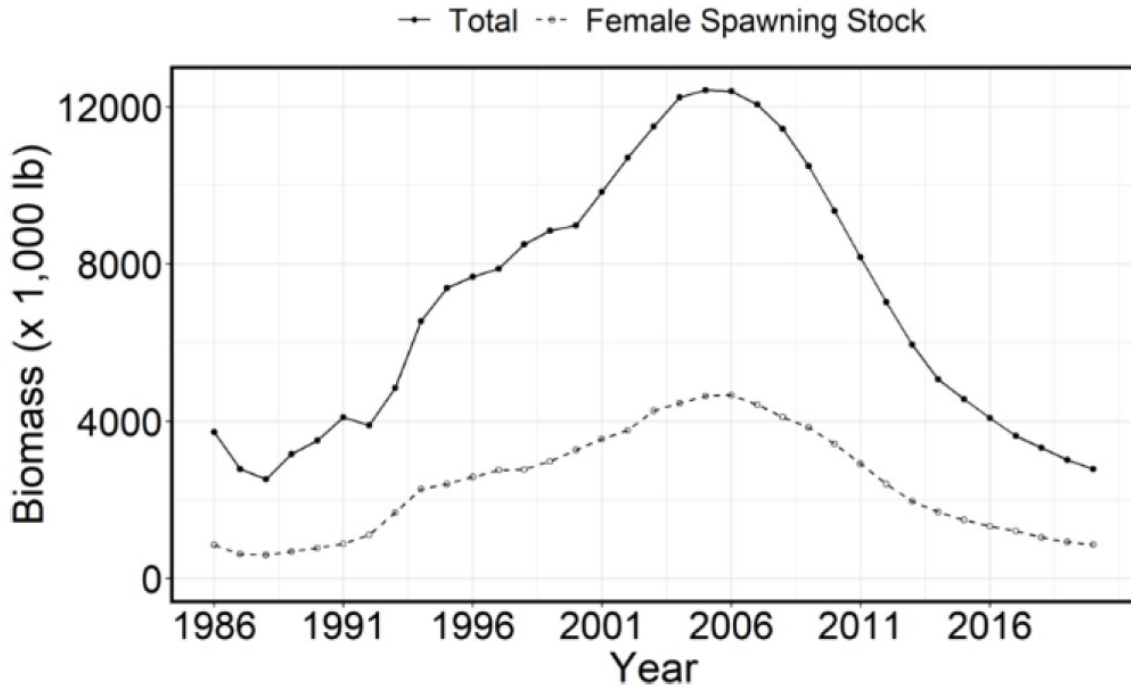


Figure 15: Estimated lake whitefish biomass in WFM-01 (MSC 2022).

In the second lake whitefish management unit (WFM-02), over the last 5 years, catch rates are relatively constant; however, effort has declined to the lowest values in 10 years (Figure 16) (MSC 2022).

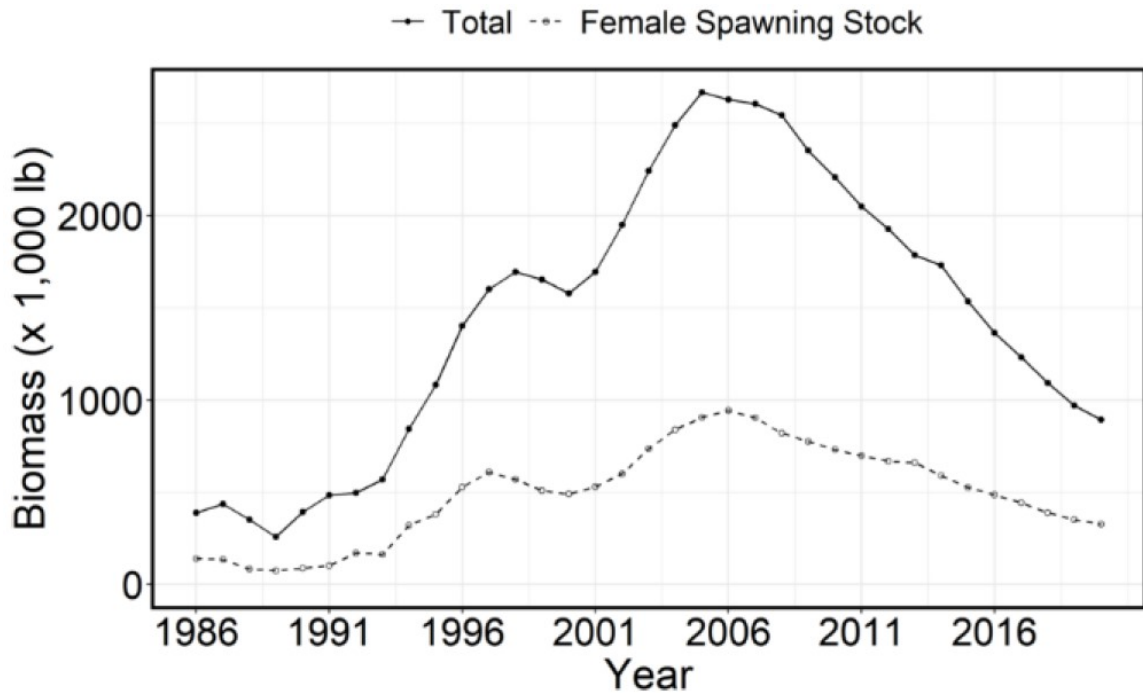


Figure 16: Estimated lake whitefish biomass in WFM-02 (MSC 2022).

In the third lake whitefish management unit (WFM-03), both trap net and gillnet effort have declined over the time series, and a continued decline in biomass has been observed since the late 2000s (Figure 17) (MSC 2022).

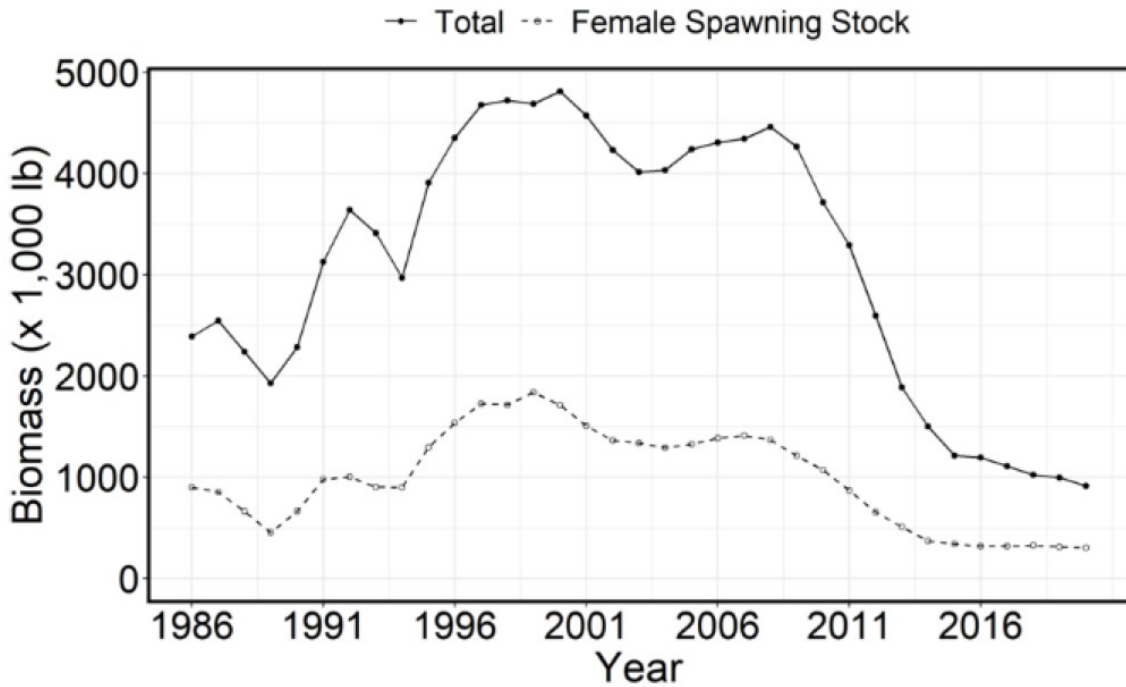


Figure 17: Estimated lake whitefish biomass in WFM-03 (MSC 2022).

During 2019 and 2020 in the fourth lake whitefish management unit (WFM-04), harvest, effort, and CPUE were the lowest on record (Figure 18) (MSC 2022). This may be attributed to challenging logistical obstacles in the fishery as a result of the COVID-19 pandemic and the low number of fishers in this unit (MSC 2022).

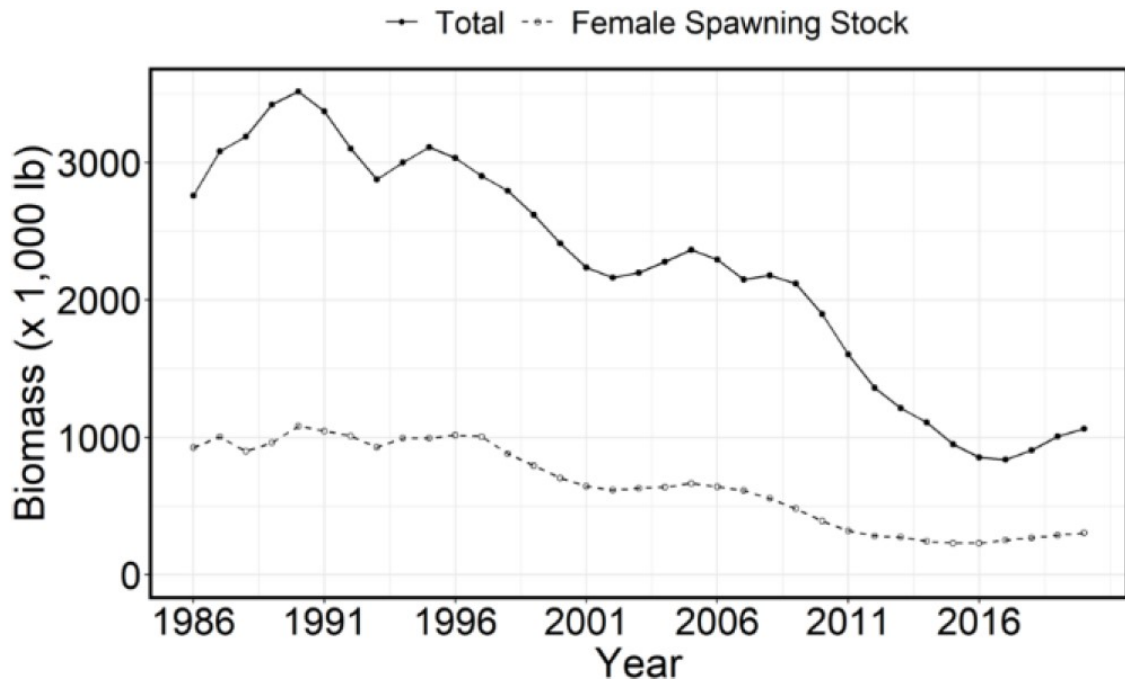


Figure 18: Estimated lake whitefish biomass in WFM-04 (MSC 2022).

Despite consistent fishing effort in the fifth lake whitefish management unit (WFM-05), yields have declined by 85% since 2015 (Figure 19) (MSC 2022).

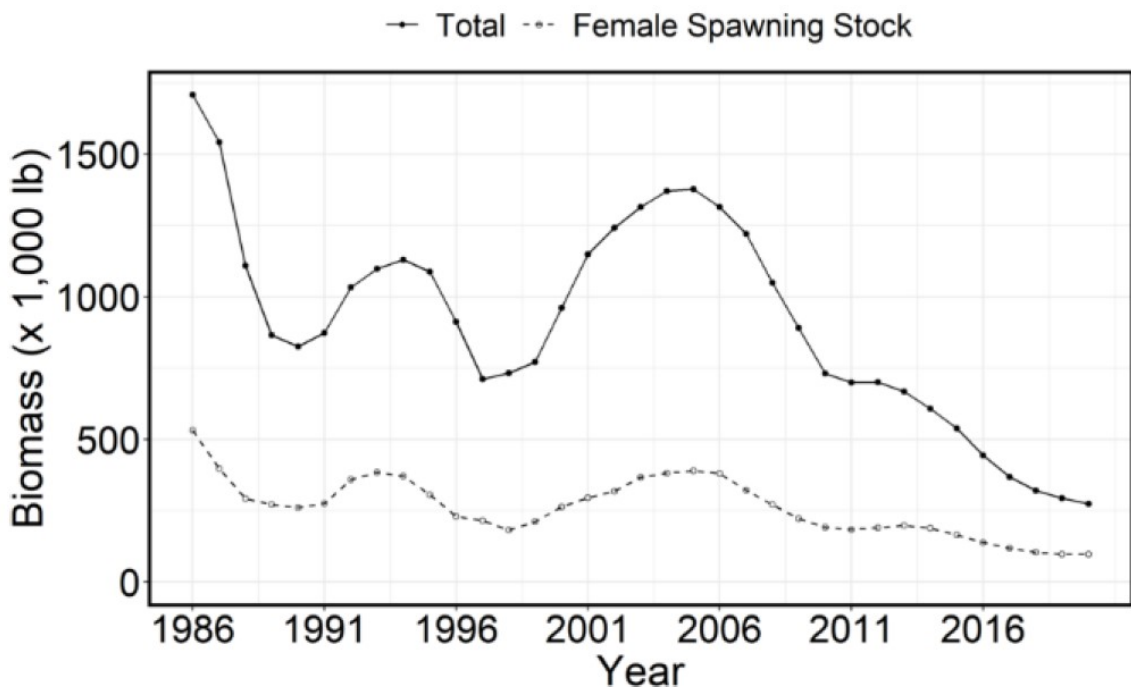


Figure 19: Estimated lake whitefish biomass in WFM-05 (MSC 2022).

In the sixth lake whitefish management unit (WFM-06), gillnet effort and yield have been sporadic since 2016 (Figure 20) (MSC 2022). On the other hand, trap net effort has been stable over the past 5 years, but catch rates and yield have declined consistently, resulting in a time series low in 2020 (MSC 2022).

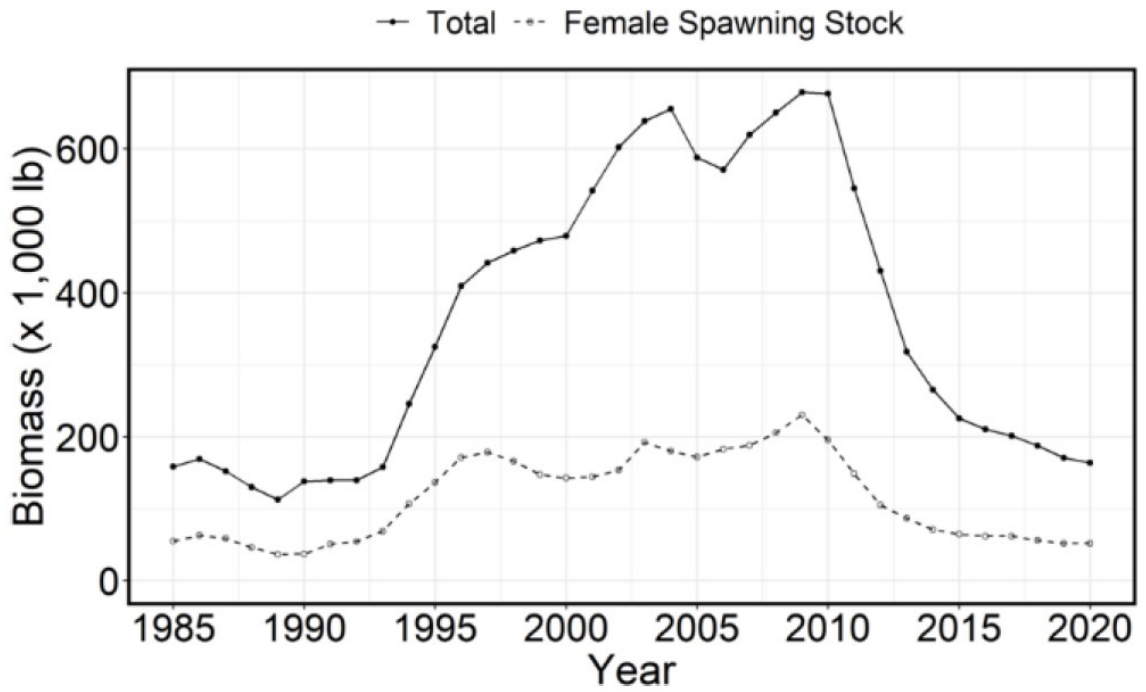


Figure 20: Estimated lake whitefish biomass in WFM-06 (MSC 2022).

No stock assessment model was conducted for the seventh lake whitefish management unit because of quite low effort levels (MSC 2022). In the eighth lake whitefish management unit, trap net effort declined in 2020 to the lowest observed effort level since the mid-2000s (Figure 21) (MSC 2022). Yield was also at a time-series low, which resulted from the reduction in effort and catch rates over the past 2 years (MSC 2022).

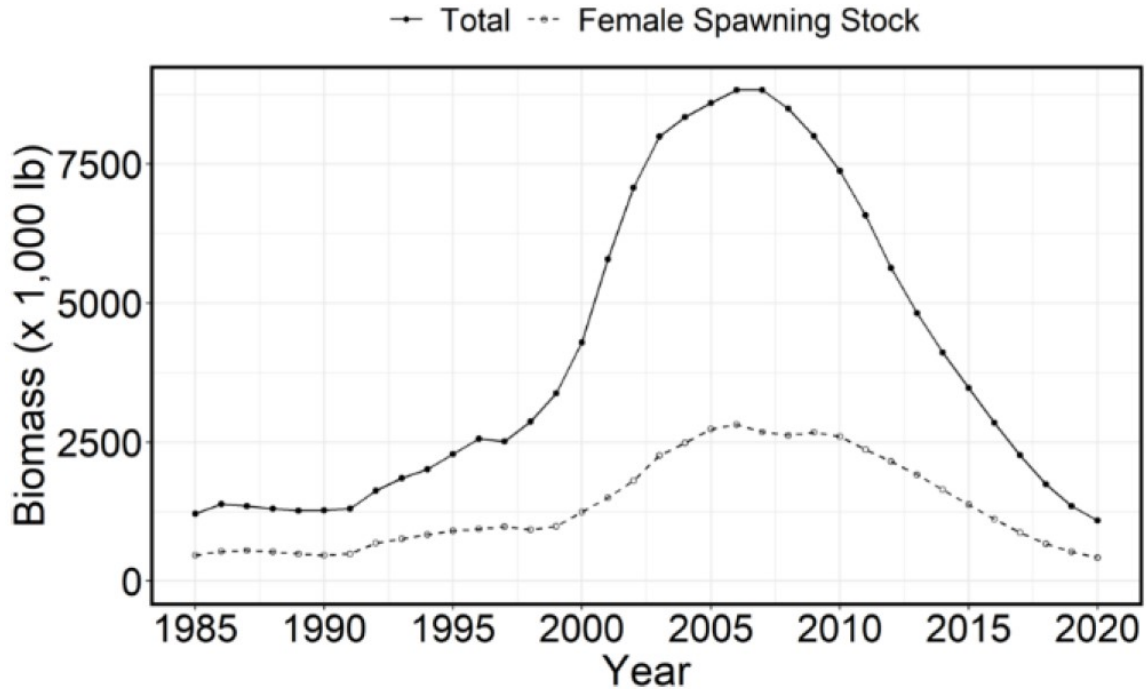


Figure 21: Estimated lake whitefish biomass in WFM-08 (MSC 2022).

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls

Low Concern

The most recent data-limited stock assessment for lake whitefish in the Wisconsin waters of Lake Michigan and Green Bay was conducted in 2023, utilizing data through 2021 (WDNR 2023). Two statistical catch at age (SCAA) population models (one for Lake Michigan and one for Green Bay) have been developed to better describe population dynamics for the Wisconsin waters of Green Bay and Lake Michigan (WDNR 2023). This is because recent tagging studies have indicated that fish originating from each area maintain a relatively discrete distribution, with limited mixing (WDNR 2023). Therefore, the lake whitefish populations from the Wisconsin waters of Lake Michigan and from the Wisconsin waters of Green Bay are managed independently of one another (WDNR 2023). Thus, considering that the Wisconsin lake whitefish bottom trawl fishery occurs only in the Wisconsin waters of Lake Michigan, abundance will be scored according to only the Lake Michigan population model.

The stock assessment model utilizes both fishery-independent and fishery-dependent information (WDNR 2023)(Hansen 2023, pers comm). The total biomass and female spawning stock biomass have steadily declined, and estimates for the management unit are shown in Figure 22 (see Justification) (WDNR 2023). The current SSBR (1.06) for the Lake Michigan population was above 75% of the target SSBR (SSBR_{TARGET}: 1.12). The current SPR for the Lake Michigan population was 0.69, which is above 75% of the target SPR (SPR_{TARGET}: 0.73) (WDNR 2023). Therefore, because data-limited assessments are available and the current population is at least 75% of the target reference points, per the Seafood Watch Standard for Fisheries, abundance has been collectively scored a low concern.

Justification:

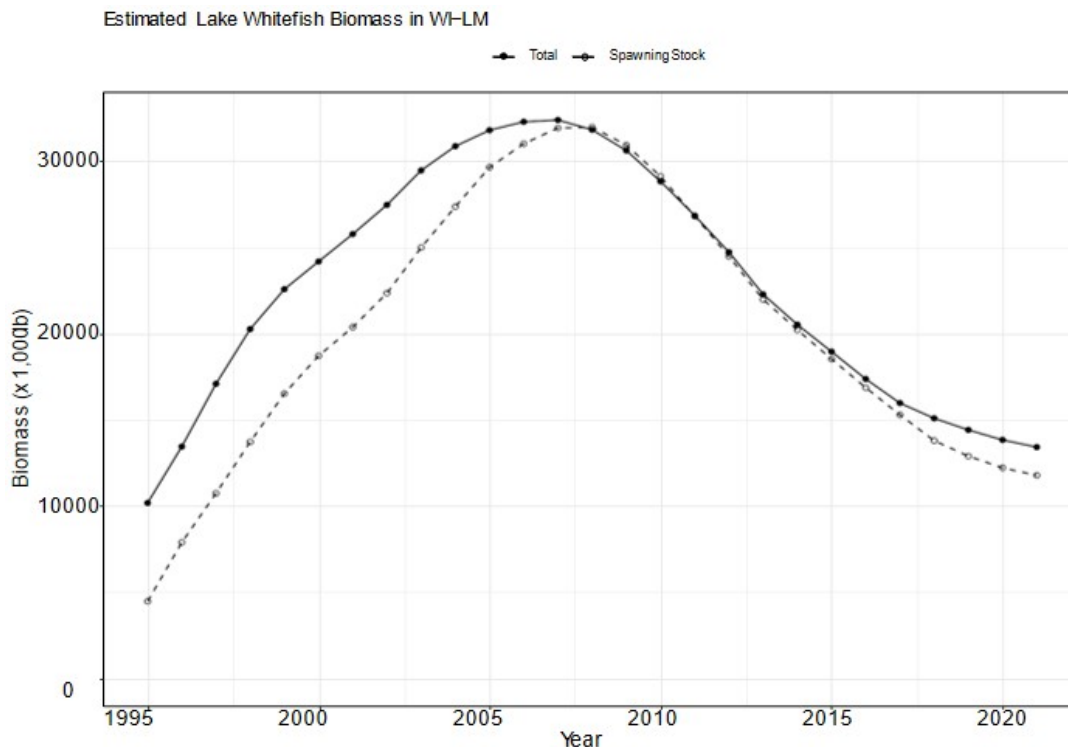


Figure 22: Estimated lake whitefish biomass in Wisconsin waters of Lake Michigan (WDNR 2023).

**Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets**

Low Concern

The most recent data-limited stock assessment for lake whitefish in the Wisconsin waters of Lake Michigan and Green Bay was conducted in 2023, utilizing data through 2021 (WDNR 2023). Two statistical catch at age (SCAA) population models (one for Lake Michigan and one for Green Bay) have been developed to better describe population dynamics for the Wisconsin waters of Green Bay and Lake Michigan (WDNR 2023). This is because recent tagging studies have indicated that fish originating from each area maintain a relatively discrete distribution, with limited mixing (WDNR 2023). Therefore, the lake whitefish populations from the Wisconsin waters of Lake Michigan and from the Wisconsin waters of Green Bay are managed independently of one another (WDNR 2023). Thus, considering that the Wisconsin lake whitefish gillnet and trap net fisheries occur in both the Wisconsin waters of Green Bay and Lake Michigan, abundance will be scored according to both population models.

Stock assessment models utilize both fishery-independent and fishery-dependent information (WDNR 2023)(Hansen 2023, pers comm). The total biomass and female spawning stock biomass estimates for each management unit are shown in Figures 22–23 (see Justification) (WDNR 2023). For the Lake Michigan population, the current SSBR was above 75% of the target SSBR ($SSBR_{CURRENT}$: 1.06; $SSBR_{TARGET}$: 1.12) (WDNR 2023). For the Green Bay population, the current SSBR was above the target SSBR ($SSBR_{CURRENT}$: 0.63; $SSBR_{TARGET}$: 0.62) (WDNR 2023). Also, the current SPR for the

Lake Michigan population was 0.69, which is above 75% of the target SPR (SPR_{TARGET} : 0.73). For the Green Bay population, the current SPR was at the target SPR ($SPR_{CURRENT}$: 0.63; SPR_{TARGET} : 0.63) (WDNR 2023). Recruitment has decreased over the past several years in the Lake Michigan population, but has remained relatively stable in the Green Bay population (WDNR 2023).

Therefore, because data-limited assessments are available and all management units are either above the target reference point or at least 75% of the target reference point, per the Seafood Watch Standard for Fisheries, abundance has been collectively scored a low concern.

Justification:

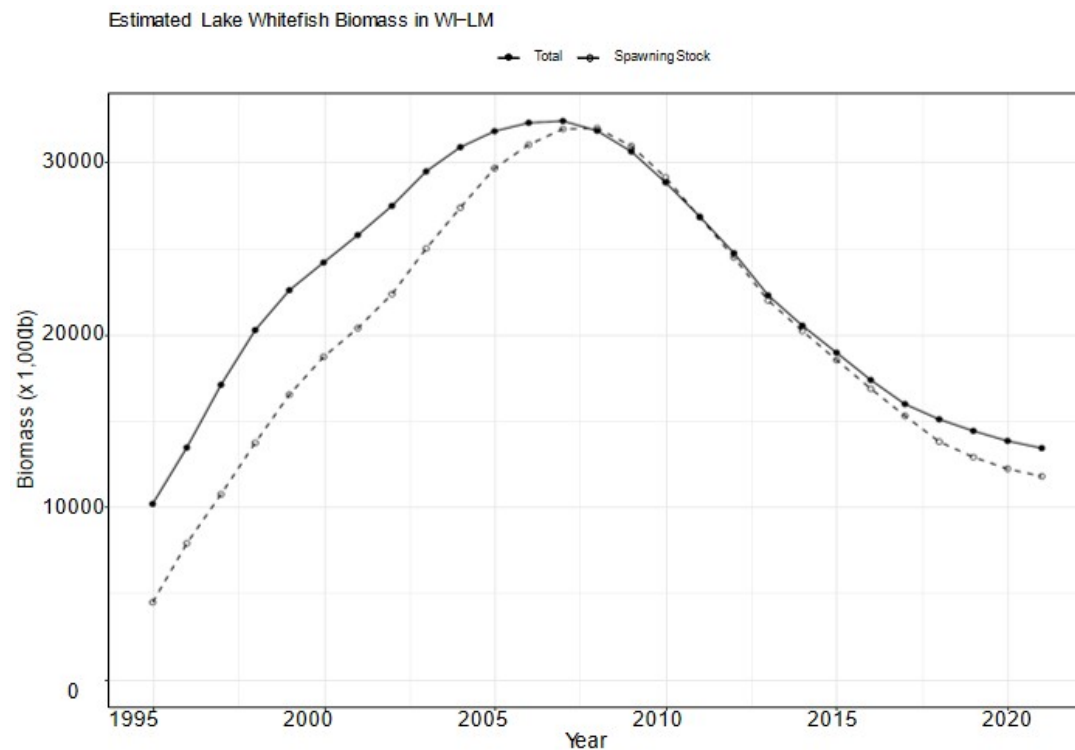


Figure 22: Estimated lake whitefish biomass in Wisconsin waters of Lake Michigan (WDNR 2023).

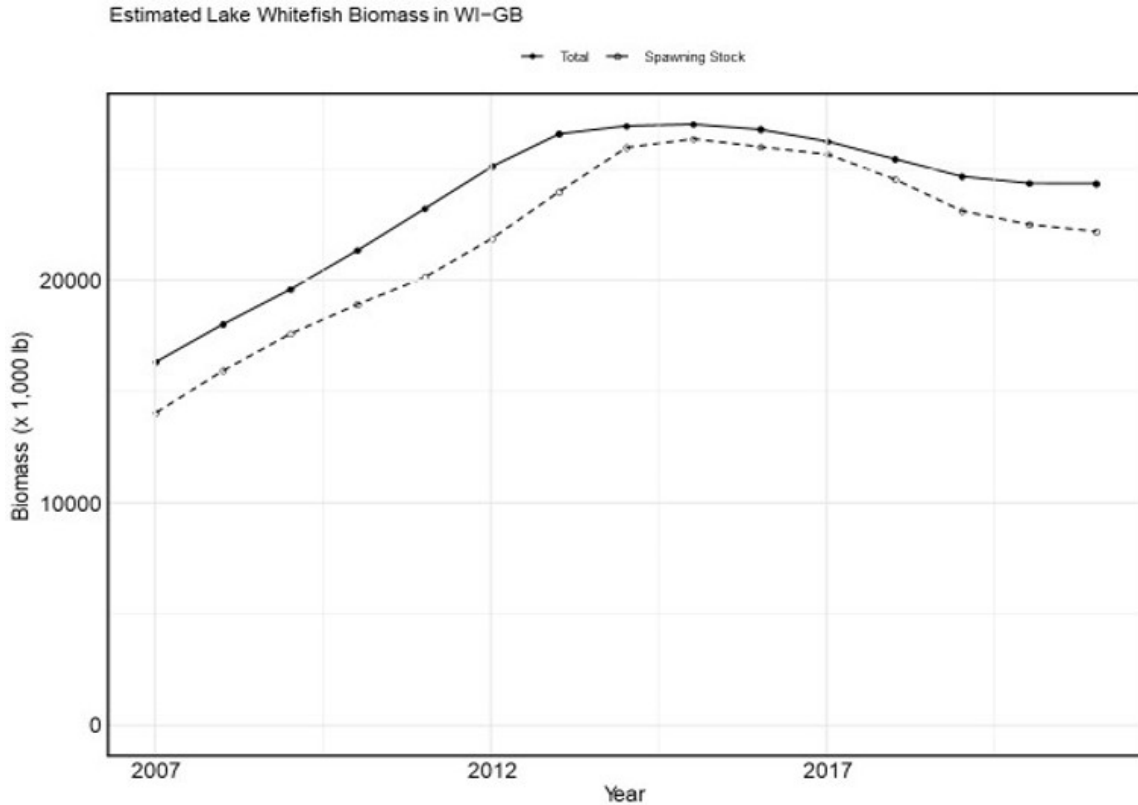


Figure 23: Estimated lake whitefish biomass in the Wisconsin waters of Green Bay (WDNR 2023).

Factor 1.2 - Fishing Mortality

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Low Concern

Lake whitefish harvested in the Michigan waters of Lake Michigan is taken by both tribal (gillnet and trap net) and state (trap net) commercial fisheries. The most recent data-limited stock assessment from 2022 conducted in Michigan waters of Lake Michigan for lake whitefish indicated that commercial fishing mortality for the trap net fisheries (averaged from 2018 to 2020) was 0.15/y for WFM-01, 0.04/y for WFM-02, 0.06/y for WFM-03, 0.01/y for WFM-04, 0.01/y for WFM-05, 0.06/y for WFM-06, and 0.07/y for WFM-08 (no stock assessment was conducted for WFM-07) (MSC 2022). The commercial fishing mortality for the gillnet fisheries (averaged from 2018 to 2020) was 0.05/y for WFM-02, 0.14/y for WFM-03, 0.05/y for WFM-04, and 0.05/y for WFM-05 (the gillnet fishery was not present in WFM-01, WFM-06, or WFM-08, and no stock assessment was conducted for WFM-07) (MSC 2022). The 2020 total mortality (Z) estimates for WFM-01, WFM-02, WFM-03, WFM-04, WFM-05, WFM-06, and WFM-08 were 0.30/y, 0.25/y, 0.36/y, 0.29/y, 0.27/y, 0.26/y, and 0.25/y, respectively (MSC 2022). Estimates for each management unit were below the target reference points set for each management unit (Figures 24-30). Because more than 70% of the stocks are below the target reference point in their respective management units, fishing mortality has been collectively scored a low concern.

Justification:

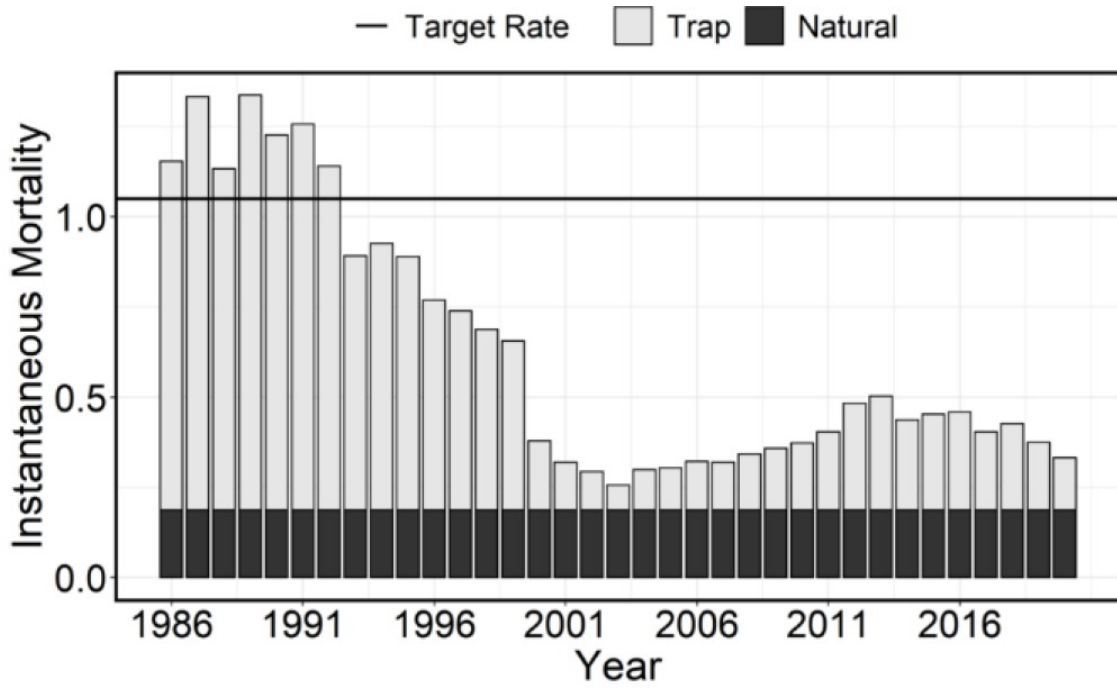


Figure 24: Maximum mortality rates for lake whitefish in WFM-01 (MSC 2022).

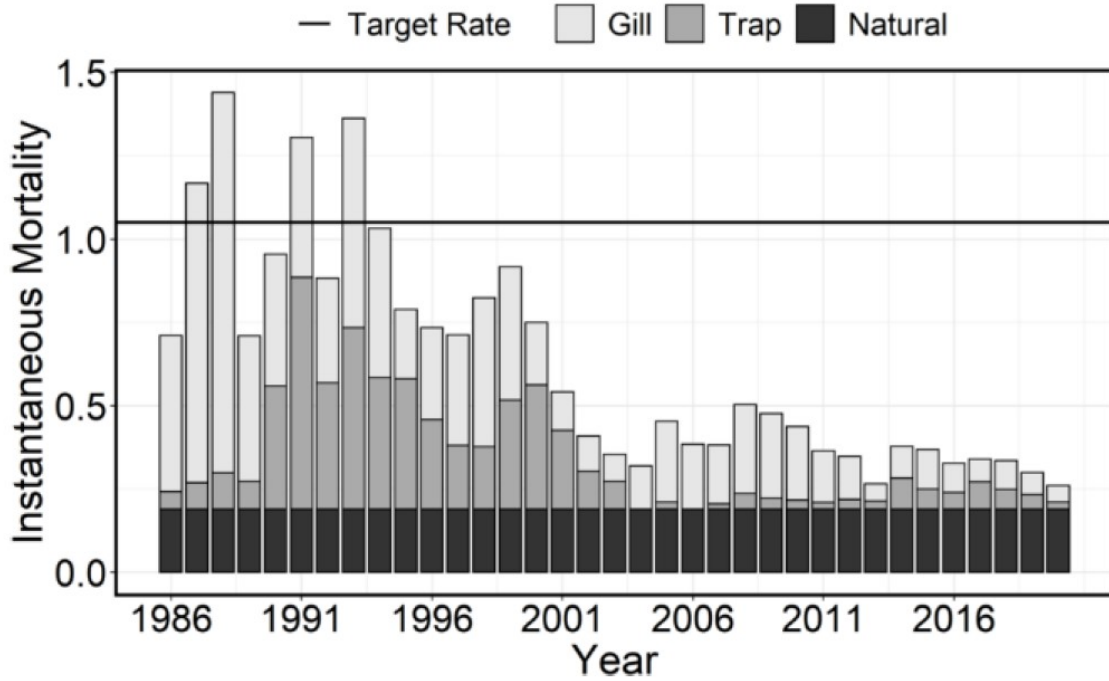


Figure 25: Maximum mortality rates for lake whitefish in WFM-02 (MSC 2022).

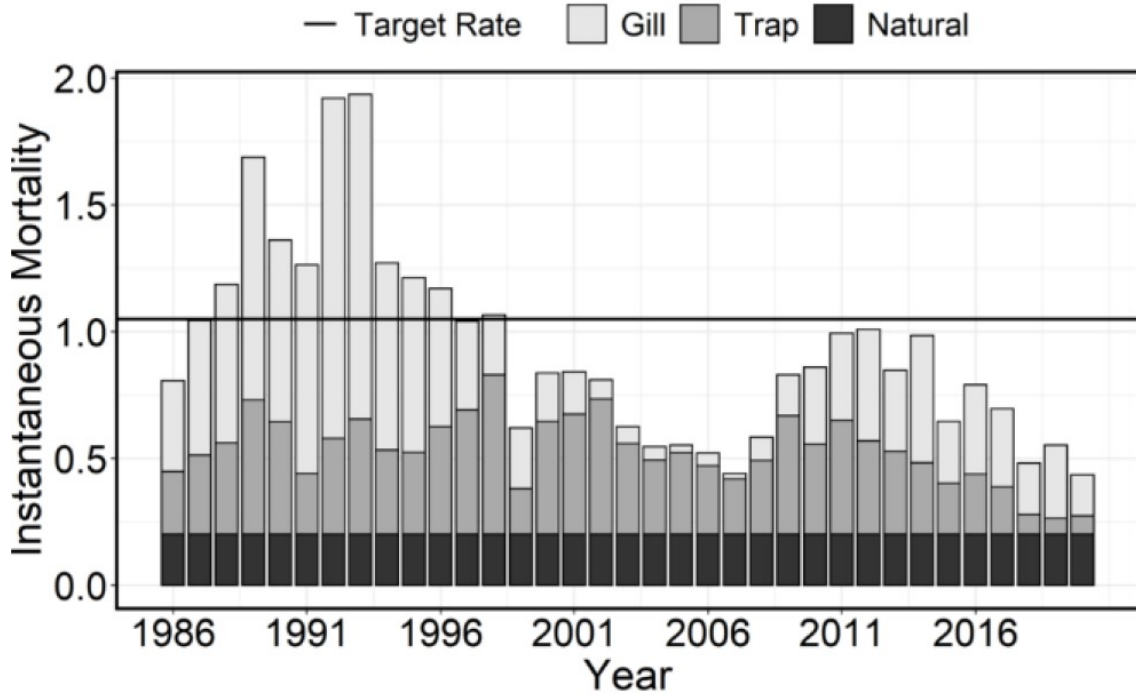


Figure 26: Maximum mortality rates for lake whitefish in WFM-03 (MSC 2022).

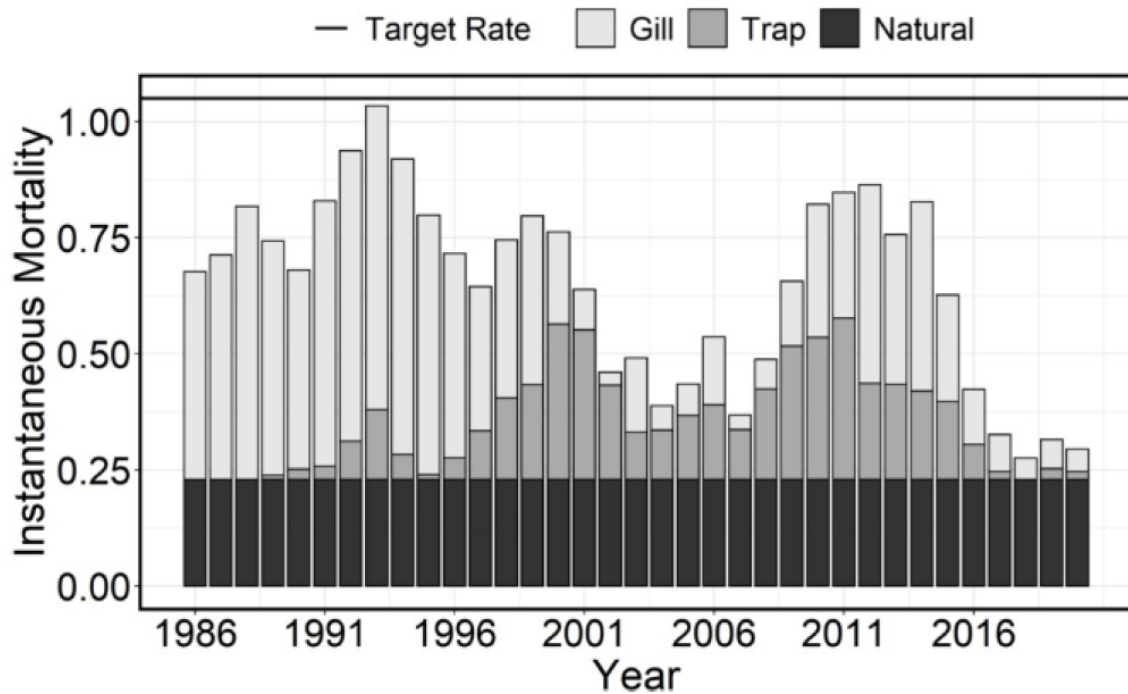


Figure 27: Maximum mortality rates for lake whitefish in WFM-04 (MSC 2022).

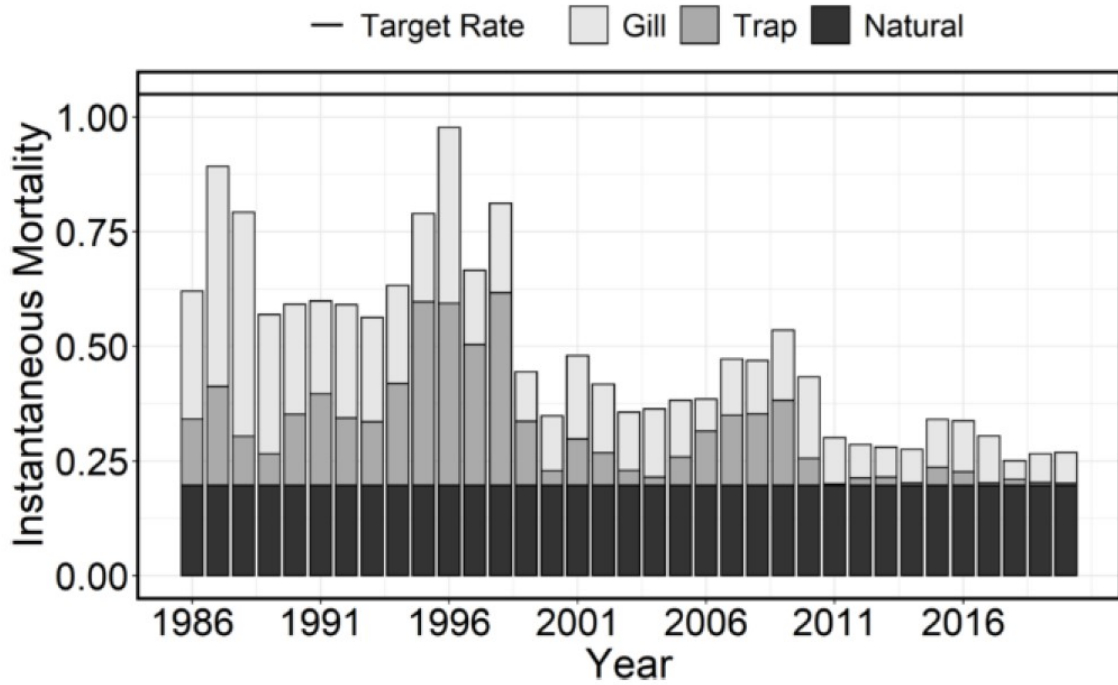


Figure 28: Maximum mortality rates for lake whitefish in WFM-05 (MSC 2022).

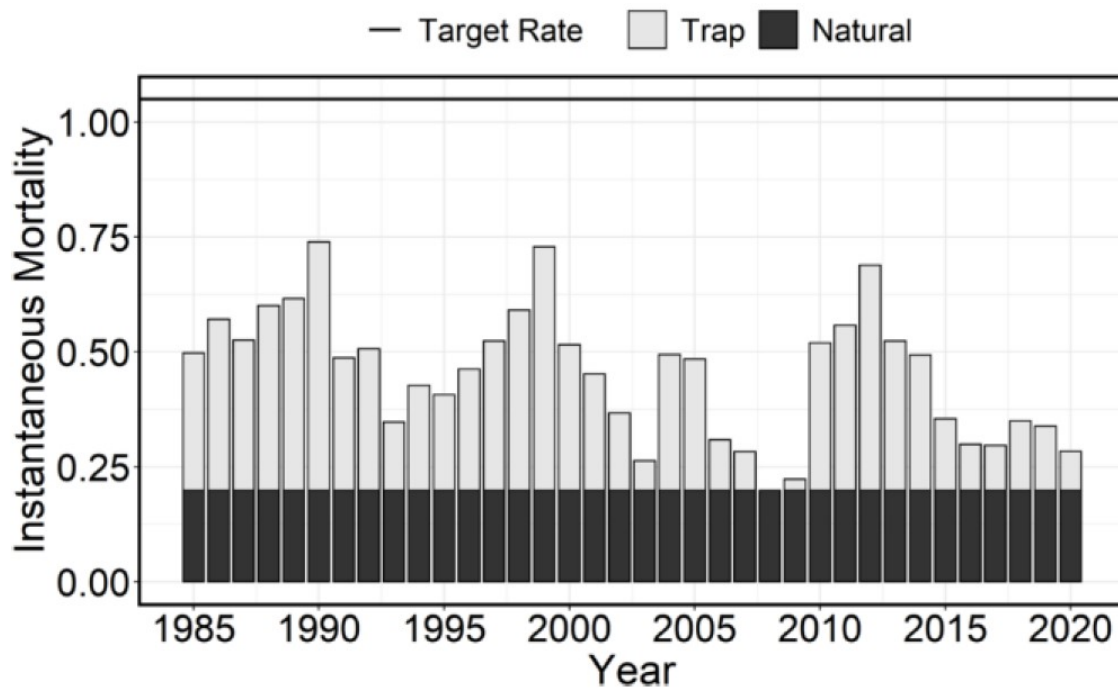


Figure 29: Maximum mortality rates for lake whitefish in WFM-06 (MSC 2022).

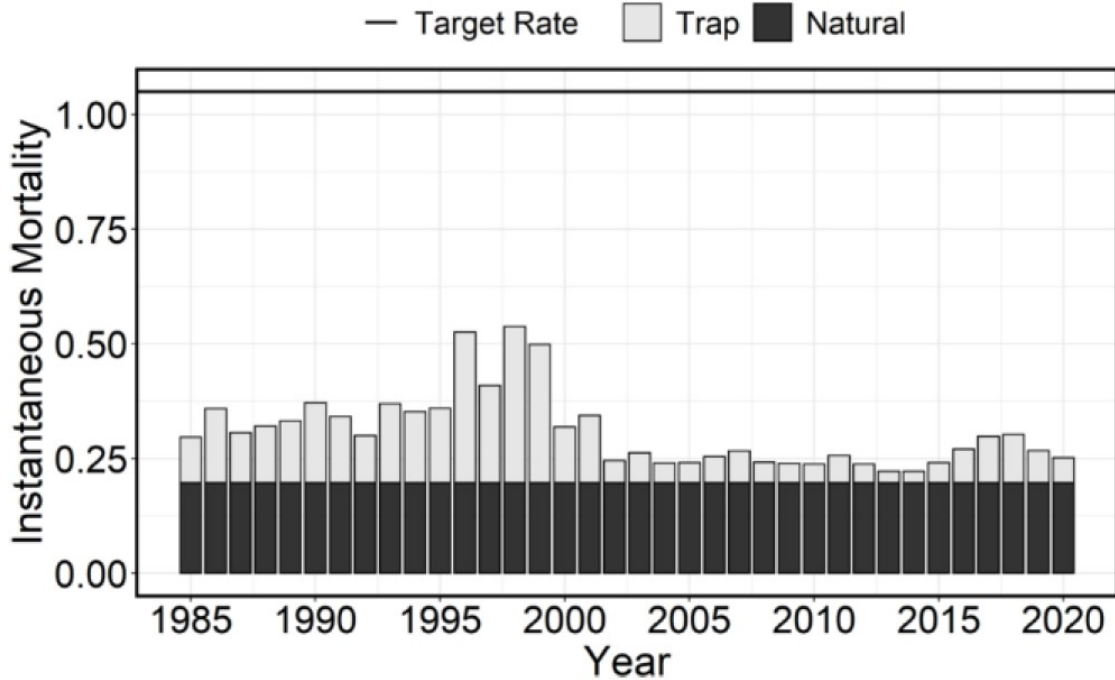


Figure 30: Maximum mortality rates for lake whitefish in WFM-08 (MSC 2022).

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls

Low Concern

The Wisconsin lake whitefish bottom trawl fishery occurs only in the Wisconsin waters of Lake Michigan. Thus, fishing mortality will be scored according to this one population. The most recent data-limited stock assessment that was conducted in 2023 combined the bottom trawl fishery statistics into the trap net fishery for modeling purposes, because of the limited amount of years that the bottom trawl fishery has been active (Hansen 2023, pers comm). Therefore, commercial fishing mortality for the bottom trawl fishery (averaged from 2019 to 2021) was 0.013/y (WDNR 2023)(Hansen 2023, pers comm). The Z total mortality (Z) estimate of the Lake Michigan population was 0.212/y (WDNR 2023) (Hansen 2023, pers comm). Estimates were below the target reference points set for the Lake Michigan population (Figure 31). Because fishing mortality from all sources is below the target reference point, fishing mortality has been collectively scored a low concern.

Justification:

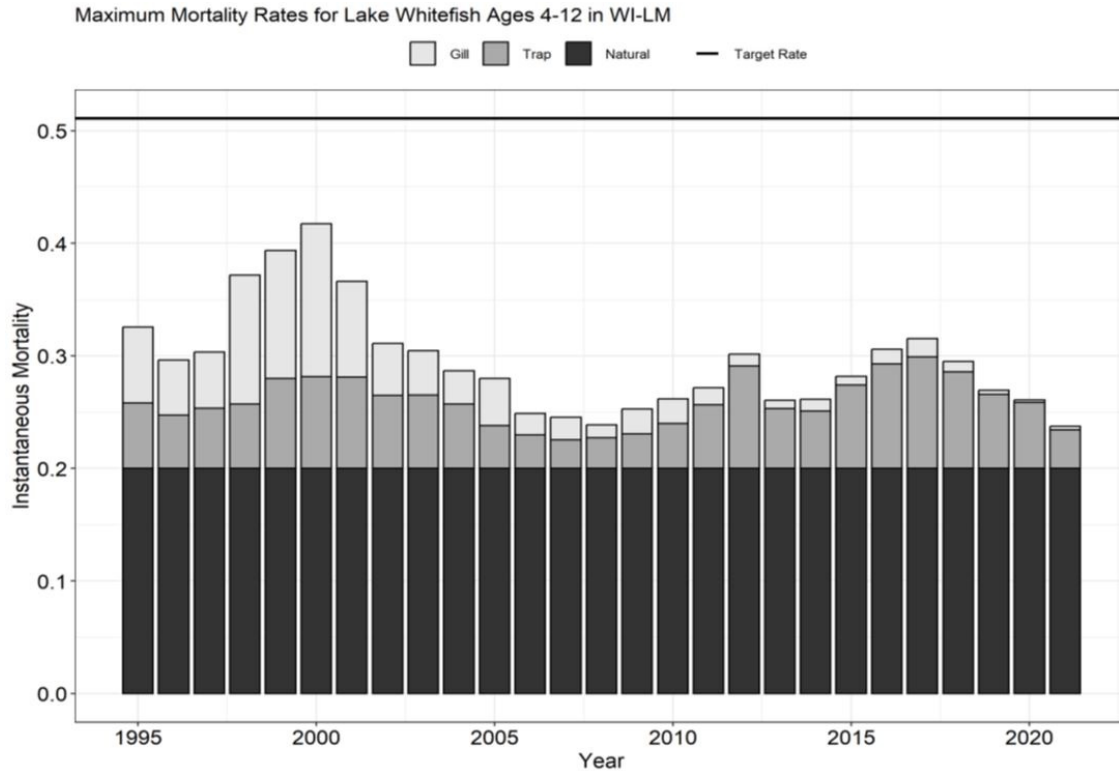


Figure 31: Maximum mortality rates for lake whitefish in the Wisconsin waters of Lake Michigan (WDNR 2023).

**Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary
uncovered pound nets**

Low Concern

The Wisconsin lake whitefish gillnet and trap net fisheries occur in both the Wisconsin waters of Green Bay and Lake Michigan. Thus, fishing mortality will be scored according to both stocks. The most recent data-limited stock assessment that was conducted in 2023 indicated that the commercial fishing mortality for the trap net fishery (averaged from 2019 to 2021) was 0.013/y for the Lake Michigan population and 0.018/y for the Green Bay population (WDNR 2023)(Hansen 2023, pers comm). The commercial fishing mortality for the gillnet fishery (averaged from 2019 to 2021) was 0.002/y for the Lake Michigan population and 0.003/y for the Green Bay population (WDNR 2023) (Hansen 2023, pers comm). The 2021 total mortality (Z) estimates for the Lake Michigan and the Green Bay populations were 0.21/y and 0.23/y, respectively (WDNR 2023)(Hansen 2023, pers comm). Estimates for each management unit were below the target reference points set for each management unit (Figures 31–32). Because all stocks in each management unit are below the target reference point, fishing mortality has been collectively scored a low concern.

Justification:

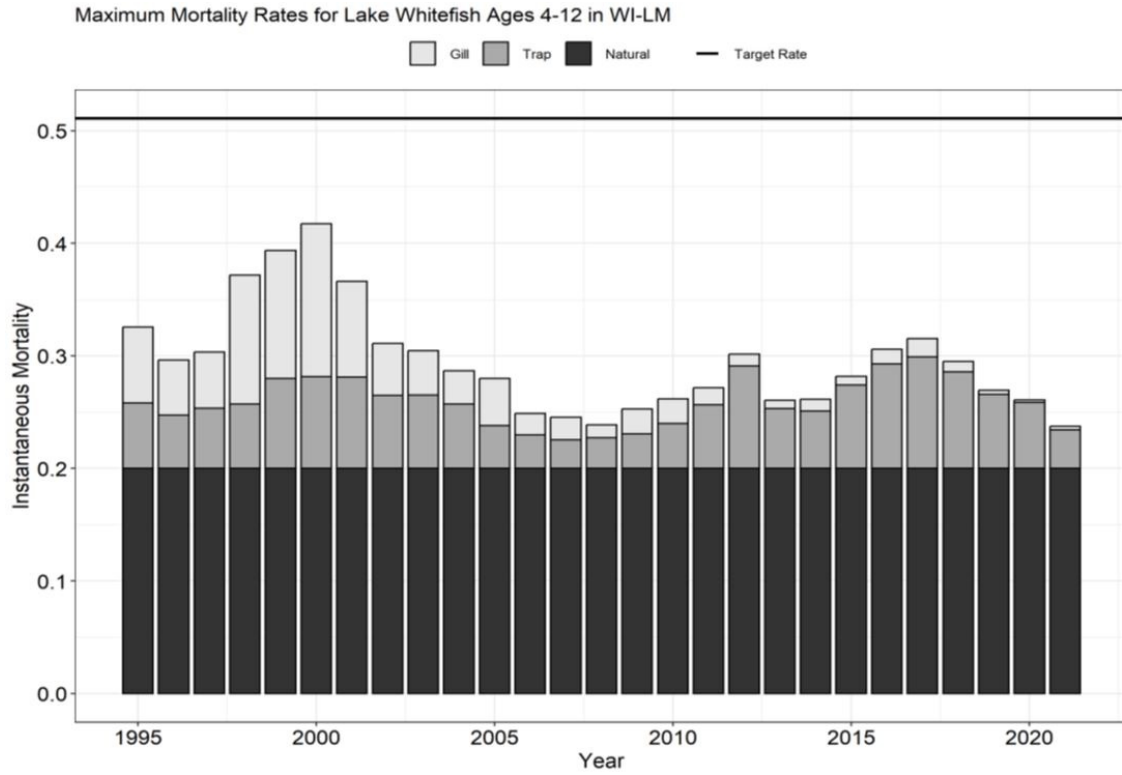


Figure 31: Maximum mortality rates for lake whitefish in the Wisconsin waters of Lake Michigan (WDNR 2023).

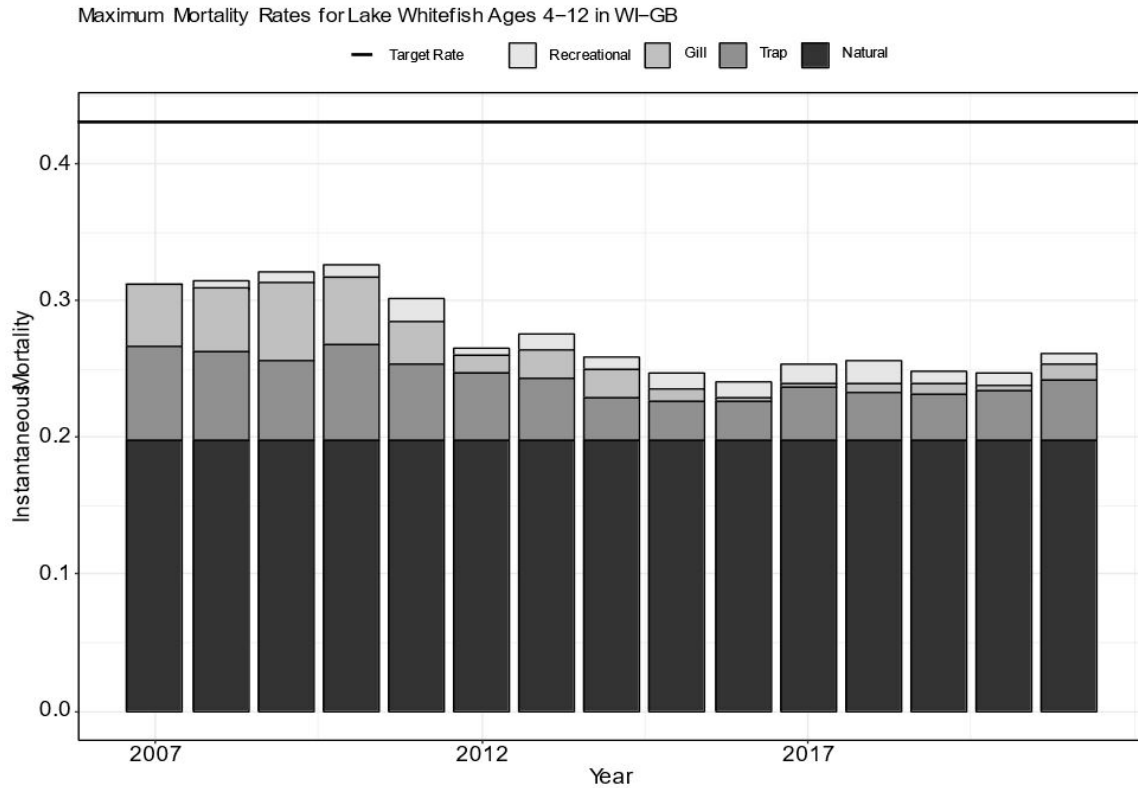


Figure 32: Maximum mortality rates for lake whitefish in the Wisconsin waters of Green Bay (WDNR 2023).

Walleye (*Sander vitreus*)

Factor 1.1 - Abundance

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Moderate Concern

There are no quantitative stock assessments or data-limited assessments conducted for walleye in Michigan waters of Lake Michigan. Thus, a productivity-susceptibility analysis (PSA) was conducted. The PSA score of walleye caught using gillnets and trap nets in the Michigan waters of Lake Michigan was 3.10, indicating that it has medium vulnerability (see Justification). Therefore, abundance has been scored a moderate concern.

Justification:

The productivity-susceptibility analysis of walleye in the Lake Michigan is as follows:

Productivity Attribute	Relevant Information	Score (1 = high, 2 = medium, 3 = low)

Average age at maturity	Males mature at 2–3 years and females mature at 4–5 years (WDNR 2008)	1
Von Bertalanffy growth coefficient (K)	K = 0.4 (Froese and Pauly 2023a)	1
Fecundity	>50,000 eggs during a spawning period (WDNR 2008)	1
Average maximum size	Lmax = 107 cm TL (Froese and Pauly 2023a)	2
Average size at maturity	Lm = 42.5 cm (Froese and Pauly 2023a)	2
Reproductive strategy	Broadcast spawner (Froese and Pauly 2023a)	1
Productivity score (P)		1.333

Susceptibility Attribute	Relevant Information	Score (1 = high, 2 = medium, 3 = high susceptibility)
Areal overlap	Default score used	3
Vertical overlap	Default score used	3
Seasonal availability	>6 months (MDNR 2023b)	3
Selectivity of the fishery	Default score used	2
Post-capture mortality	Retained species—default score used	3
Susceptibility score (S)		2.8

$$\text{Vulnerability} = \sqrt{(P^2 + S^2)}$$

$$V = \sqrt{(1.333^2 + 2.8^2)}$$

$$V = 3.10 \text{ (medium vulnerability)}$$

Factor 1.2 - Fishing Mortality

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Moderate Concern

Commercial walleye harvest in the Michigan waters of Lake Michigan is taken solely by tribal fisheries operating in tribal waters (MDNR 2023a)(Michigan Sea Grant 2023c). A fish community objective (FCO) has been established for walleye, which states that expected annual yields for walleye are to be between 200,000 and 400,000 lbs (90.7 to 181.4 MT) (GLFC 2021). In 2021 and 2022, total walleye harvest (commercial, sport, weir, assessment, and incidental catch) has been above this FCO, because there has been an increasing trend in walleye harvest lake-wide (Figure 33) (Redman 2023). In 2020, the walleye tribal fishery harvested a total of 1.89 MT of walleye (the average from 2016 to 2020 was 2.39 MT) (GLFC 2022b). But because there are no available reference points to determine whether F is at an appropriate level, fishing mortality has been scored a moderate concern.

Justification:

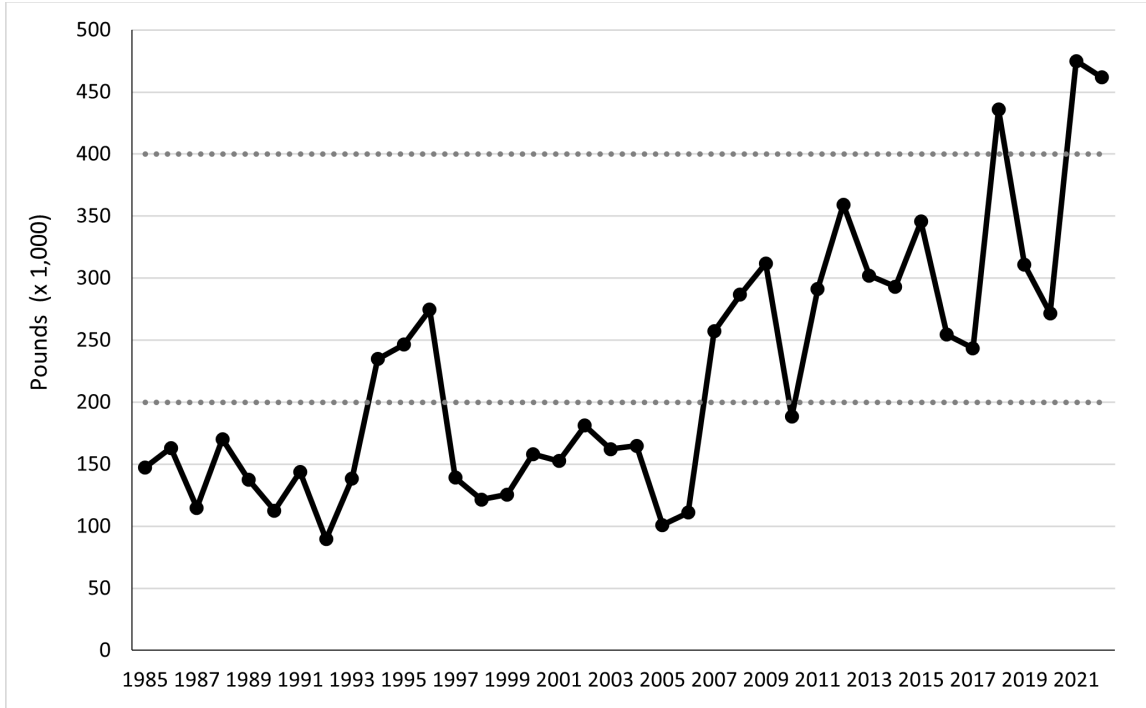


Figure 33: Total lake-wide harvest of walleye (commercial, sport, weir, assessment, and incidental catch) in Lake Michigan, 1985–2022 (Redman 2023). Grey dashed lines represent the fish community objective range of 0.2 to 0.4 million lb.

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical

Guiding principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

LAKE TROUT			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	4.284	1.000: < 100%	Green (4.284)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	4.284	1.000: < 100%	Green (4.284)

LAKE WHITEFISH			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Michigan America, North - Inland Waters United States Wisconsin Bottom trawls	5.000	1.000: < 100%	Green (5.000)
Lake Michigan America, North - Inland Waters United States Wisconsin Set gillnets	5.000	1.000: < 100%	Green (5.000)
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	3.318	1.000: < 100%	Green (3.318)
Lake Michigan America, North - Inland Waters United States Wisconsin Stationary uncovered pound nets	5.000	1.000: < 100%	Green (5.000)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets	5.000	1.000: < 100%	Green (5.000)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	5.000	1.000: < 100%	Green (5.000)

WALLEYE			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	3.318	1.000: < 100%	Green (3.318)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	5.000	1.000: < 100%	Green (5.000)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

LAKE MICHIGAN | AMERICA, NORTH - INLAND WATERS | UNITED STATES | SET GILLNETS | TRIBAL FISHERY

SUB SCORE: 4.284		DISCARD RATE: 1.000	SCORE: 4.284
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Walleye	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Lake trout	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Lake whitefish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

LAKE MICHIGAN | AMERICA, NORTH - INLAND WATERS | UNITED STATES | STATIONARY UNCOVERED POUND NETS

SUB SCORE: 5.000		DISCARD RATE: 1.000	SCORE: 5.000
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Lake whitefish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

LAKE MICHIGAN | AMERICA, NORTH - INLAND WATERS | UNITED STATES | STATIONARY UNCOVERED POUND NETS | TRIBAL FISHERY

SUB SCORE: 4.284		DISCARD RATE: 1.000	SCORE: 4.284
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Walleye	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Lake trout	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Lake whitefish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

LAKE MICHIGAN | AMERICA, NORTH - INLAND WATERS | UNITED STATES | WISCONSIN | BOTTOM TRAWLS

SUB SCORE: 5.000		DISCARD RATE: 1.000	SCORE: 5.000
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Lake whitefish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

LAKE MICHIGAN | AMERICA, NORTH - INLAND WATERS | UNITED STATES | WISCONSIN | SET GILLNETS

SUB SCORE: 5.000		DISCARD RATE: 1.000	SCORE: 5.000
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Lake whitefish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

LAKE MICHIGAN AMERICA, NORTH - INLAND WATERS UNITED STATES WISCONSIN STATIONARY UNCOVERED POUND NETS			
SUB SCORE: 5.000		DISCARD RATE: 1.000	SCORE: 5.000
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Lake whitefish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

Tribal- and state-licensed commercial fisheries that target lake whitefish, lake trout, and walleye in Lake Michigan typically catch low amounts of nontarget species. In summary, the only fisheries to include additional main species are the Michigan tribal-licensed gillnet and trap net fisheries targeting walleye, lake trout, and lake whitefish. This is because, according to harvest data from 2017 to 2020, the tribal-licensed gillnet fishery’s catch comprised 72.37% lake trout, 24.15% lake whitefish, and 0.58% walleye (Caroffino 2023, pers comm). Because both lake whitefish and lake trout compose more than 5% of the catch, following the Seafood Watch Standard for Fisheries, lake whitefish and lake trout were added as main species in the Michigan tribal-licensed walleye gillnet fishery, lake whitefish was added as a main species in the Michigan tribal-licensed lake trout gillnet fishery, and lake trout was added as a main species in the Michigan tribal-licensed lake whitefish gillnet fishery. Similarly, according to harvest data from 2017 to 2020, the tribal-licensed trap net fishery’s catch comprised 0.46% lake trout, 99.28% lake whitefish, and 0.04% walleye (Caroffino 2023, pers comm). Because lake whitefish composes more than 5% of the catch, following the Seafood Watch Standard for Fisheries, lake whitefish was added as a main species in the Michigan tribal-licensed walleye trap net fishery and the Michigan tribal-licensed lake trout trap net fishery. No main species were included in any other fisheries assessed in this report (details follow).

Lake sturgeon (listed as “Threatened” by the state of Michigan, categorized as a “Special Concern” species in the state of Wisconsin, and globally listed as “Endangered” by the International Union for the Conservation of Nature, IUCN) is one species of concern that overlaps with the fisheries assessed in this report (Hayes and Caroffino 2012)(Wisconsin Natural Heritage Program 2021)(Haxton and Bruch 2022). There is no total lake sturgeon population estimate in Lake Michigan; however, the population is considered stable and increasing, because there are an estimated 3,000 spawning adults in Lake Michigan waters (Collier 2022)(WDNR 2022a). Also, landings and retention of lake sturgeon in Lake Michigan are prohibited (Hayes and Caroffino 2012). In addition, fishing methods utilized in Lake Michigan (gillnets, trap nets, and bottom trawls) are not believed to have significant impacts on lake sturgeon, and most fish that are incidentally caught with such gears are returned to the water alive (Hayes and Caroffino 2012)(Seilheimer 2023, pers comm). Habitat alteration and degradation are currently believed to be the greatest remaining threats to the lake sturgeon population (Haxton and Bruch 2022). Per the Seafood Watch Fisheries Standard and based on the catch composition data provided, the incidental catch of lake sturgeon that occurs in some of the fisheries assessed in this report has no more than a negligible impact on the lake sturgeon population (details follow). Therefore, lake sturgeon is not included in the assessment for any of the Lake Michigan fisheries assessed in this report.

Michigan State-Licensed Lake Whitefish Trap Net Commercial Fishery

Bycatch is minimal in the fishery, because nontarget species cannot be retained or sold (Caroffino 2023, pers comm). According to the Michigan state-licensed lake whitefish trap net harvest data from 2017 to 2020, lake whitefish made up approximately 99.81% of the total catch, so no other main species were included in the fishery.

Wisconsin State-Licensed Lake Whitefish Bottom Trawl Fishery

Data from a 3-year bycatch study conducted on the lake whitefish bottom trawl fishery in the Wisconsin waters

of Lake Michigan from 2015 to 2018 were utilized to identify the main species to include in this fishery (Seilheimer 2019). During the study period, 1,441 trawls were completed that harvested more than 245,000 lake whitefish and captured 10 bycatch species, which represented 2.4% of the total catch (Seilheimer 2019). Of the 10 bycatch species, one species (lake sturgeon) is considered a species of concern. But over the 3-year period, only two lake sturgeon were captured, and both were returned to the water alive (Seilheimer 2019)(Seilheimer 2023, pers comm). Therefore, no Criterion 2 species were included for the Wisconsin bottom trawl fishery, because no species were identified as a common component of the catch (i.e., greater than 5% of the catch per the Seafood Watch Fisheries Standard), no species of concern were caught regularly, and the fishery did not significantly contribute to their conservation concern (Seilheimer 2019).

Wisconsin State-Licensed Lake Whitefish Trap Net Fishery

Data from a 2-year bycatch study in the Wisconsin waters of Lake Michigan were utilized to identify main species to include in the assessment of the Wisconsin state-licensed lake whitefish trap net fishery (Hrabak 2022). In 2021, observer coverage was roughly 21.6%, which totaled 389 observed trap net lifts (Hrabak 2022). Lake whitefish (harvest and discards) made up roughly 98% (harvest: 48%; discard: 50%) of the total catch in 2021 (Hrabak 2022). Of the lake whitefish discards in 2021, <5% were entangled in the trap net while the remaining were contained free-swimming in the net pot (Hrabak 2022). In addition, lake whitefish discard mortality was <3% in 2021 (Hrabak 2022). A total of nine lake sturgeon were caught in the monitored trap nets in 2021 (Hrabak 2022). Therefore, no Criterion 2 species were included for the Wisconsin bottom trawl fishery, because no species were identified as a common component of the catch (i.e., greater than 5% of the catch per the Seafood Watch Fisheries Standard), no species of concern were caught regularly, and the fishery did not significantly contribute to their conservation concern (Hrabak 2022).

Wisconsin State-Licensed Lake Whitefish Gillnet Fishery

Data from a 2-year bycatch study in the Wisconsin waters of Lake Michigan were utilized to identify main species to include in the assessment of the Wisconsin state-licensed lake whitefish gillnet fishery (Hrabak 2022). In 2021, observer coverage was roughly 13.7%, which totaled 47 observed gillnet lifts or 68,092 m of gillnet (Hrabak 2022). Lake whitefish harvest made up roughly 88% of the total catch in 2021, with no other remaining species representing >5% of the catch (Hrabak 2022). Bycatch is minimized in the gillnet fishery by setting nets for short daytime temporal scales and targeting schooling lake whitefish (Seilheimer 2023, pers comm). Also, regulations require nets to be moved to different areas when bycatch is too high, thus further minimizing bycatch in the fishery (Seilheimer 2023, pers comm). Therefore, no Criterion 2 species were included in this fishery, because no species were identified as a common component of the catch (i.e., greater than 5% of the catch per the Seafood Watch Fisheries Standard), no species of concern were caught regularly, and the fishery did not significantly contribute to their conservation concern (Hrabak 2022).

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality
(same as Factor 1.2 above)

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss.

For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

	Ratio of bait + discards/landings	Factor 2.3 score
<100%		1
>=100		0.75

Lake trout (*Salvelinus namaycush*)

Factor 2.3 - Discard Rate/Landings

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

< 100%

Discards are quite low for both state and tribal-licensed gillnet and trap net fisheries in the Michigan waters of Lake Michigan (Caroffino 2023, pers comm)(Gonia 2023, pers comm). Hence, we consider the ratio of discards to landings to be <100%.

Lake whitefish (*Coregonus clupeaformis*)

Factor 2.3 - Discard Rate/Landings

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

< 100%

Discards are quite low for both state and tribal-licensed gillnet and trap net fisheries in the Michigan waters of Lake Michigan (Caroffino 2023, pers comm)(Gonia 2023, pers comm). Hence, we consider the ratio of discards to landings to be <100%.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls

< 100%

Data from a 3-year harvest and bycatch study conducted on the lake whitefish bottom trawl fishery in the Wisconsin waters of Lake Michigan indicated that bycatch was 2.4% of the total catch (Seilheimer 2019), so the ratio of discards to landings is assumed to be low. Therefore, this factor has been scored as <100%.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets

< 100%

Data from a 2-year bycatch study in the Wisconsin waters of Lake Michigan identified that lake whitefish made up roughly 88.86% (harvest: 87.56%; discard: 1.3%) of the total catch (harvest and discards) in 2021 for the gillnet fishery (Hrabak 2022). Therefore, this factor has been scored as <100%.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets

< 100%

Data from a 2-year bycatch study in the Wisconsin waters of Lake Michigan identified that lake whitefish made up roughly 98% (harvest: 48%; discard: 50%) of the total catch (harvest and discards) in 2021 for the trap net fishery (Hrabak 2022). Of the lake whitefish discards in 2021, <5% were entangled in the trap net while the remaining were contained free-swimming in the net pot (Hrabak 2022). Also, lake whitefish discard mortality was <3% in 2021 (Hrabak 2022). Therefore, this factor has been scored as <100%.

Walleye (*Sander vitreus*)

Factor 2.3 - Discard Rate/Landings

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

< 100%

Discards are quite low for both state and tribal-licensed gillnet and trap net fisheries in the Michigan waters of Lake Michigan (Caroffino 2023, pers comm)(Gonia 2023, pers comm). Hence, we consider the ratio of discards to landings to be <100%.

Factor 2.3 - Discard Rate/Landings

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

< 100%

Discards are quite low for both state and tribal-licensed gillnet and trap net fisheries in the Michigan waters of Lake Michigan (Caroffino 2023, pers comm)(Gonia 2023, pers comm). Hence, we consider the ratio of discards to landings to be <100%.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls

< 100%

Data from a 3-year harvest and bycatch study conducted on the lake whitefish bottom trawl fishery in the Wisconsin waters of Lake Michigan indicated that bycatch was 2.4% of the total catch (Seilheimer 2019), so the ratio of discards to landings is assumed to be low. Therefore, this factor has been scored as <100%.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets

< 100%

Data from a 2-year bycatch study in the Wisconsin waters of Lake Michigan identified that lake whitefish made up roughly 88.86% (harvest: 87.56%; discard: 1.3%) of the total catch (harvest and discards) in 2021 for the gillnet fishery (Hrabak 2022). Therefore, this factor has been scored as <100%.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets

< 100%

Data from a 2-year bycatch study in the Wisconsin waters of Lake Michigan identified that lake whitefish made up roughly 98% (harvest: 48%; discard: 50%) of the total catch (harvest and discards) in 2021 for the trap net fishery (Hrabak 2022). Of the lake whitefish discards in 2021, <5% were entangled in the trap net while the remaining were contained free-swimming in the net pot (Hrabak 2022). Also, lake whitefish discard mortality was <3% in 2021 (Hrabak 2022). Therefore, this factor has been scored as <100%.

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- 5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.
- 4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.
- 3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.
- 2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'
- 1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'
- 0 (Critical) — Management Strategy and Implementation is 'critical'.

The Criterion 3 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Rating is Critical if Management Strategy and Implementation is Critical.

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species.

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	DATA COLLECTION AND ANALYSIS	ENFORCEMENT	INCLUSION	SCORE
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	Yellow (3.000)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets	Highly effective	Highly effective	Moderately Effective	Highly effective	Highly effective	Green (4.000)

Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	Yellow (3.000)
Lake Michigan America, North - Inland Waters United States Wisconsin Bottom trawls	Highly effective	Highly effective	Highly effective	Highly effective	Highly effective	Green (5.000)
Lake Michigan America, North - Inland Waters United States Wisconsin Set gillnets	Highly effective	Highly effective	Moderately Effective	Highly effective	Highly effective	Green (4.000)
Lake Michigan America, North - Inland Waters United States Wisconsin Stationary uncovered pound nets	Highly effective	Highly effective	Moderately Effective	Highly effective	Highly effective	Green (4.000)

The Great Lakes Fishery Commission (GLFC) is an interjurisdictional agency comprising eight Commissioners (four from Canada and four from the United States) and one U.S. Alternate Commissioner, and is the main coordinating body of fisheries management for Lake Michigan (GLFC 2023a). In 1981, a Joint Strategic Plan for Management of Great Lakes Fisheries was established to facilitate working relationships among parties (GLFC 2007)(GLFC 2023a)(GLFC 2023c). This cooperative fishery management process is guided by four principles: consensus, accountability, information sharing, and ecosystem-based management (GLFC 2023a)(GLFC 2023c). Specific to each lake, “lake committees” are established, which comprise state, provincial, and U.S. tribal agencies, and are the primary management jurisdiction on each lake (Figure 34) (GLFC 2023a)(GLFC 2023c). The purpose of the lake committees is to develop strategic management goals called Fish Community Objectives (FCO) and set cooperative harvest levels, management plans, and rehabilitation plans (Eshenroder et al. 1995)(GLFC 2023a)(GLFC 2023c). Each lake committee includes at least one technical committee that is responsible for collecting data, producing and interpreting science, and making recommendations to the lake committee (GLFC 2023a) (GLFC 2023c).

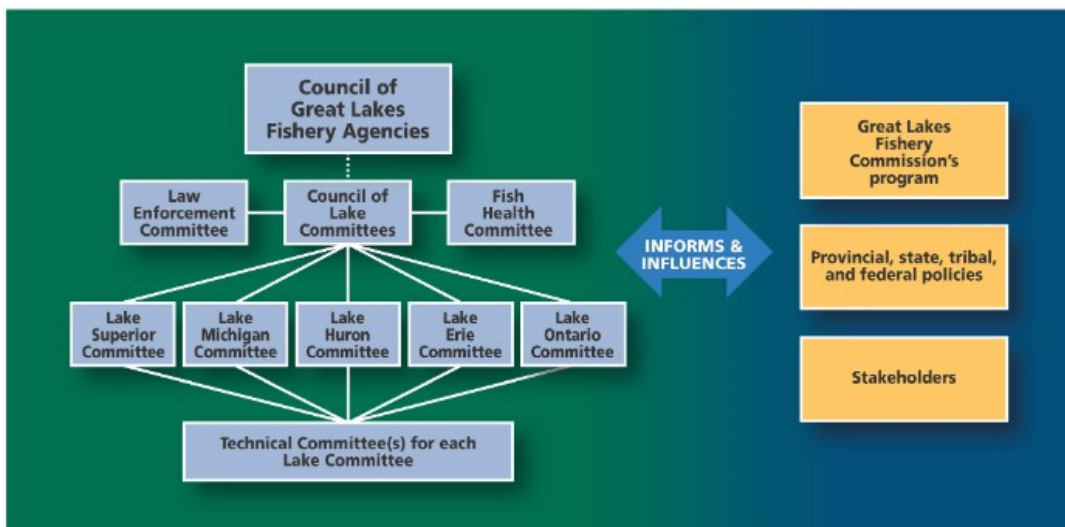


Figure 34: Great Lakes Management Structure (GLFC 2023c).

The Lake Michigan Committee comprises senior staff members from the Illinois Department of Natural Resources, Indiana Department of Natural Resources, Michigan Department of Natural Resources, Wisconsin Department of Natural Resources, and the Chippewa-Ottawa Resource Authority (CORA) (GLFC 2023b). The Lake Michigan Committee is responsible for (1) developing and coordinating joint state, provincial, federal, and tribal management programs and research projects; (2) considering issues and problems of common concern to Illinois, Indiana, Michigan, Wisconsin, and CORA; (3) considering issues pertinent to, or referred by, the GLFC that are within the Lake Michigan Committee's authority or under its auspices; (4) determining issues for referral to the GLFC or the Council of Lake Committees for direction, resolution, or support; (5) serving as a forum for state, tribal, and federal agencies, and other, on a need or request basis; and (6) deciding protocol for its operation, establishing operational procedures for internal committees, and developing meeting agendas (GLFC 2023b). The Lake Michigan Committee established FCOs in 1995 to ensure unification in interjurisdictional fisheries management strategies, which are outlined in the most recent State of the Lake Report for Lake Michigan (Eshenroder et al. 1995)(GLFC 2021).

The Technical Fisheries Committee comprises fishery biologists from the Illinois Department of Natural Resources, Indiana Department of Natural Resources, Michigan Department of Natural Resources, Wisconsin Department of Natural Resources, the Sault Saint Marie Tribe of Chippewa Indians, the Little Traverse Bay Band of Odawa Indians, the Little River Band of Ottawa Indians, the Grand Traverse Band of Ottawa and Chippewa Indians, the Bay Mills Indian Community, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey (GLFC 2023b). The Technical Fisheries Committee is responsible for (1) providing agencies represented on the Lake Michigan Committee with technical information on the status of stocks, including management alternatives and guidelines in making and evaluating fisheries management decisions; (2) arranging for resource persons to assist the members as required; and (3) advising the Lake Michigan Committee Chairman of any additional funding or other requirements as needed (GLFC 2023b). The Lake Trout Working Group aids in management and supports the Technical Fisheries Committee by assessing the progress of rehabilitation toward meeting the FCOs (GLFC 2023b)(LML TWG 2021).

In 1836, the Ottawa and Chippewa nations of Indians ceded their territories to the United States, but reserved their rights to harvest natural resources from their lands, as documented in the 1836 Treaty and shown in the following map (Figure 37) (US and OCI 1836)(Falck et al. 2015). Thus, five tribes (the Bay Mills Indian Community, Little Traverse Bay Bands of Odawa Indians, Grand Traverse Band of Chippewa Indians, Little River Band of Odawa Indians, and the Sault Ste. Marie Tribe of Chippewa Indians) have the right to fish in 1836 Treaty-ceded-waters of Lake Michigan (US and OCI 1836)(Falck et al. 2015)(United States v. Michigan 2023). Further, in 2023, the 2023 Great Lakes Decree was signed that governs the allocation, management, and regulation of state and tribal fisheries in the 1836 Treaty Waters of Lake Michigan (United States v. Michigan 2023). The purpose of this Decree is to facilitate cooperative management of the shared resource through efficient communication, research collaboration, and data sharing, and to ensure transparency in management decisions (United States v. Michigan 2023). Regulations set forth by the Decree include licensing requirements, spatial and temporal closures and regulations, and gear requirements and restrictions (United States v. Michigan 2023). The tribes are governed by the CORA Charter, Tribal Plan, and Tribal Code for management and regulation of their fisheries (United States v. Michigan 2023); however, the Decree requires that the tribes also abide by the terms set forth by the Decree (United States v. Michigan 2023).

CORA, the CORA Charter, and the Tribal Code were established to ensure the conservation and utilization of the natural resources reserved to the tribes in the 1836 Treaty waters of Lake Michigan (CORA 2019)(CORA 2022a). The Charter sets forth measures of the Great Lakes Resource Committee (an intertribal management

body), which comprises a board of members from each tribe that is a member of CORA (CORA 2022a). The Great Lakes Resource Committee must abide by the Tribal Plan and the Decree in developing procedures for fisheries management (e.g., harvest reduction, seasonal closures, zone closure, and gear restrictions and regulations) (CORA 2019)(CORA 2022a). The purpose of the Tribal Plan is to establish how the tribes (the Bay Mills Indian Community, Grand Traverse Band of Ottawa and Chippewa Indians, Little River Band of Ottawa Indians, Little Traverse Bay Bands of Odawa Indians, and Sault Ste. Marie Tribe of Chippewa Indians) manage treaty fishing among themselves within the 1836 Treaty waters (CORA 2022b). Therefore, the Tribal Plan and the Charter establish the basis for which the tribes manage and regulate their fisheries cooperatively with the terms of the Decree (CORA 2022b). Management objectives of the Tribal Plan include (but are not limited to) ensuring that, seven generations from now, Great Lakes fishing will continue to sustain the livelihood and subsistence of tribal citizens, adopting a flexible effort-based management system (versus a strict quota-based system), and supporting lake trout and lake whitefish rehabilitation in Lake Michigan (CORA 2022b).

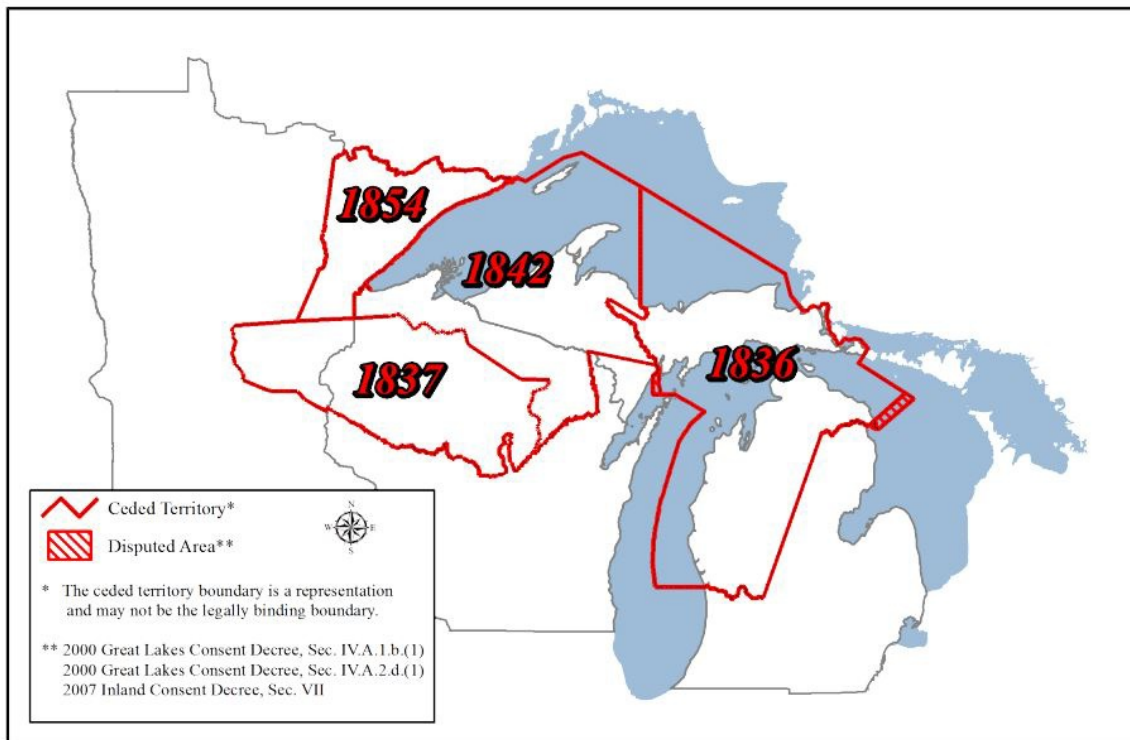


Figure 35: Map of Treaty-ceded territory boundaries in the Great Lakes Region (Falck et al. 2015).

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do managers follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Factor 3.2 - Bycatch Strategy

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Factor 3.3 - Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Factor 3.4 - Enforcement of Management Regulations

Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Factor 3.5 - Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there is a mechanism to effectively address user conflicts.

Factor 3.1 - Management Strategy And Implementation

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery

Moderately Effective

The main targeted species in the Michigan tribal-licensed large-mesh gillnet fishery is lake trout; however, lake whitefish and walleye are also retained in this fishery. Therefore, the management strategy and implementation for lake trout, lake whitefish, and walleye are considered here.

Lake Trout

Tribal-licensed large-mesh gillnet lake trout management includes limited entry, establishment of commercial fishing zones, restricted zones, gear restrictions, size restrictions, establishment of seasonal spawning closures, and setting harvest control rules (CORA 2019)(CORA 2022b)(United States v. Michigan 2023)(GLFC 2021). For example, tribal commercial fishers are prohibited from using a large-mesh gillnet with mesh greater than 5.5 inches stretch measure at any time in 1836 Treaty waters except under specific circumstances (CORA 2019). All commercial tribal-licensed large-mesh gillnet fishing and retention of lake trout is prohibited from noon on November 6 to noon on November 29, to protect lake trout spawning (CORA 2019). Two lake trout refuges are established in Lake Michigan, where retention of lake trout is prohibited (CORA 2019). All live lake trout less than 17 in long caught with gillnets must be released, and no more than 15 lbs round weight per vessel per day of undersized lake trout shall be retained by tribal gillnet fishers (CORA 2019).

Lake trout harvest limits established by the 2023 Great Lakes Decree include determination of spatial statistical districts and boundaries (e.g., MM-1, MM-2, and MM-3 are combined as MM-123 for management purposes) (United States v. Michigan 2023). Therefore, harvest limits are set for each management unit to allow for appropriate biological monitoring and assessment of lake trout populations. The Modeling Subcommittee calculates lake trout harvest limits by utilizing the target mortality rates established by the Decree (United States v. Michigan 2023). The Technical Fisheries Committee conducts statistical catch-at-age analysis models that are used to estimate abundance of lake trout in the 1836 Treaty waters of Lake Michigan as they are assessed by the 2023 Great Lakes Decree Modeling Subcommittee (United States v. Michigan 2023). Target reference points are established, and harvest limits are set in accordance with the terms of the 2023 Great Lakes Decree (United States v. Michigan 2023). The target annual mortality rates used to calculate the harvest limits are reviewed and evaluated by the Technical Fisheries Committee at least every 6 years beginning in 2028 (United States v. Michigan 2023). Harvest limits are set in place and held constant for lake trout for three consecutive years (e.g., lake trout monitoring occurs in 2023 to establish harvest limits for 2024, 2025, and 2026) (United States v. Michigan 2023). In addition, recent lake trout mortality in some management units was above the target rate and has been above target reference point for almost every year of the previous 2000 Consent Decree (MSC 2022). The Decree further requires that the tribes adopt and use an Electronic Reporting System for the collection, reporting, and sharing of information regarding commercial harvest of lake trout in the Lake Michigan (MSC 2022).

Further, two specific lake trout FCOs were developed: (1) establish a diverse salmonine community capable of sustaining an annual harvest of 2.7 to 6.8 million kg, of which 20–25% is lake trout, and (2)

establish self-sustaining lake trout populations (Eshenroder et al. 1995)(GLFC 2021). The purposes of these two objectives are to maintain a diverse fishery for lake trout and salmon and to foster rehabilitation of wild lake trout populations (Eshenroder et al. 1995)(GLFC 2021). According to the Lake Trout Working Group's most recent report in 2021, the first FCO was not met because the total salmon and trout harvest was below the FCO threshold for the seventh consecutive year (2.51 million kg) and lake trout made up 32.3% of the total salmonid harvest (LMLTWG 2021). This higher percentage is mainly the result of reduced salmon harvest, because the lake trout harvest has remained stable through the time series (LMLTWG 2021). Regarding the second FCO, data suggest conflicting trajectories and conclusions for current lake trout restoration (LMLTWG 2021).

Lake Whitefish

Tribal-licensed large-mesh gillnet lake whitefish management includes limited entry, establishment of commercial fishing zones, restricted zones, gear restrictions, size restrictions, establishment of seasonal spawning closures, and setting harvest control rules (CORA 2019)(CORA 2022b)(United States v. Michigan 2023)(GLFC 2021). For example, all commercial tribal-licensed large-mesh gillnet fishing and retention of lake whitefish is prohibited from November 6 at noon to November 29 at noon to protect lake whitefish spawning (CORA 2019)(CORA 2022b). Lake whitefish smaller than 17 inches must be returned to the water, if alive, and possession of 50 lbs round weight of undersized lake whitefish is prohibited (CORA 2019)(CORA 2022b).

Lake whitefish harvest limits established by the 2023 Great Lakes Decree include the determination of spatial statistical districts and boundaries (United States v. Michigan 2023). Therefore, harvest limits are set for each management unit to allow for appropriate biological monitoring and assessment of lake whitefish populations. The Modeling Subcommittee calculates lake whitefish harvest limits by utilizing the target mortality rates established by the Decree (United States v. Michigan 2023). The Technical Fisheries Committee conducts statistical catch-at-age analysis models that are used to estimate the abundance of lake whitefish in the 1836 Treaty waters of Lake Michigan as they are assessed by the 2023 Great Lakes Decree Modeling Subcommittee (United States v. Michigan 2023). Lake whitefish target reference points are established, and harvest limits are set in accordance with the terms of the 2023 Great Lakes Decree (United States v. Michigan 2023). The target annual mortality rates used to calculate the lake whitefish harvest limits are reviewed and evaluated by the Technical Fisheries Committee at least every 6 years beginning in 2028 (United States v. Michigan 2023). Harvest limits are set in place and held constant for lake whitefish for three consecutive years (e.g., lake whitefish monitoring occurs in 2024 to establish harvest limits for 2025, 2026, and 2027) (United States v. Michigan 2023).

In addition, in lake whitefish management units that are not shared between the state and tribes, the Biological Service Division of CORA establishes, evaluates, and adjusts the benchmark harvest levels for lake whitefish (known as harvest regulation guidelines, HRGs) (CORA 2019)(CORA 2022a). The tribes must notify the Technical Fisheries Commission within 2 weeks of development (CORA 2019) (CORA 2022a). The 2023 Great Lakes Decree additionally requires the tribes to adopt and use an Electronic Reporting System for the collection, reporting, and sharing of information regarding the commercial harvest of lake whitefish in the Lake Michigan (CORA 2019)(CORA 2022a).

Further, one specific lake whitefish FCO was developed by the Lake Michigan Committee, which was to maintain self-sustaining stocks of lake whitefish, round whitefish, sturgeon, suckers, and burbot, and

the expected annual yield of lake whitefish should be 1.8–2.7 million kg (Eshenroder et al. 1995) (GLFC 2021). According to the most recent State of the Lake Michigan report, in the current reporting period (2016–21), the average annual commercial yield was less than 1.4 million kg (which does not achieve the objective) (GLFC 2021). Also, the most recent State of the Lake Michigan report highlighted that, from a lake-wide perspective, lake whitefish populations are currently unable to support fishery yields in the benchmark range (GLFC 2021).

Walleye

Tribal-license large-mesh gillnet walleye management includes the establishment of commercial and restricted fishing zones, gear restrictions, size restrictions, and establishment of seasonal spawning closures (CORA 2019)(CORA 2022b)(United States v. Michigan 2023)(GLFC 2021). For example, to protect walleye spawning stocks, in areas where commercial fishing is permitted, except under special circumstances, fishing for walleye is prohibited during the period from noon on March 15 through noon on May 1 in Lake Michigan (CORA 2019). It is prohibited to possess more than 15 lbs round weight of walleye that are less than 15 inches long caught in gillnets (CORA 2019)(CORA 2022b). No undersized walleye is permitted for sale (CORA 2019)(CORA 2022b). Walleye shall be monitored by the state and the tribes through appropriate collection of biological data from all fisheries (recreational, subsistence, and commercial) (CORA 2019)(CORA 2022b). But no stock assessment models or biological reference points are used to determine the status of walleye, and fishing mortality is considered unknown.

One specific walleye FCO was developed, which was to maintain self-sustaining stocks of yellow perch, walleye, smallmouth bass, pike, catfish, and panfish, and the expected annual yield for walleye should be 0.2 to 0.4 million lbs (Eshenroder et al. 1995)(GLFC 2021). The average walleye yield during the most recent State of the Lake reporting period (2016–21) was 0.35 million lbs (GLFC 2021). In addition, the walleye yield has been at or above the target range in 14 of the past 15 reporting years (2007–21) (GLFC 2021). But according to the Harvest of Fishes report in Lake Michigan, the total walleye harvest (commercial, sport, weir, assessment, and incidental catch) was above this FCO in 2021 and 2022, because there has been an increasing trend in walleye harvest lake-wide in recent years (Redman 2023).

Therefore, because more than 70% of the fishery's main targeted and retained stocks have measures in place that are expected to be effective, but there is a potential need for increased precaution (e.g., lake trout mortality has exceeded the target rate in recent years and no stock assessments or biological reference points have been established for walleye), a score of moderately effective is awarded for management strategy and implementation.

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Highly effective

Michigan state-licensed trap net lake whitefish management includes limited entry, the establishment of commercial fishing zones, restricted zones, gear restrictions, size restrictions, the establishment of seasonal spawning closures, and setting harvest control rules (United States v. Michigan 2023) (Madenjian 2019). For example, all commercial state-licensed trap net fishing and retention of lake whitefish is prohibited for the entire month of November to protect lake whitefish spawning (United States v. Michigan 2023). Commercial state-licensed trap net fishing is permitted in waters to 150 ft

deep in Lake Michigan (MDNR 2021). Lake whitefish harvest limits established by the 2023 Great Lakes Decree include the determination of spatial statistical districts and boundaries (United States v. Michigan 2023). Therefore, harvest limits are set for each management unit to allow for appropriate biological monitoring and assessment of lake whitefish populations.

The Modeling Subcommittee calculates lake whitefish harvest limits by utilizing the target mortality rates established by the Decree (United States v. Michigan 2023). The Technical Fisheries Committee conducts statistical catch-at-age analysis models that are used to estimate the abundance of lake whitefish in the 1836 Treaty waters of Lake Michigan as they are assessed by the 2023 Great Lakes Decree Modeling Subcommittee (United States v. Michigan 2023). Lake whitefish target reference points are established, and harvest limits are set in accordance with the terms of the 2023 Great Lakes Decree (United States v. Michigan 2023). The target annual mortality rates used to calculate the lake whitefish harvest limits are reviewed and evaluated by the Technical Fisheries Committee at least every 6 years beginning in 2028 (United States v. Michigan 2023). Harvest limits are set in place and held constant for lake whitefish for three consecutive years (e.g., lake whitefish monitoring occurs in 2024 to establish harvest limits for 2025, 2026, and 2027) (United States v. Michigan 2023). Further, one specific lake whitefish FCO was developed by the Lake Michigan Committee, which was to maintain self-sustaining stocks of lake whitefish, round whitefish, sturgeon, suckers, and burbot, and the expected annual yield of lake whitefish should be 1.8–2.7 million kg (Eshenroder et al. 1995) (GLFC 2021). According to the most recent State of the Lake Michigan report, in the current reporting period (2016–21), the average annual commercial yield was less than 1.4 million kg (which does not achieve the objective) (GLFC 2021). In addition, the most recent State of the Lake Michigan report highlighted that, from a lake-wide perspective, lake whitefish populations are currently unable to support fishery yields in the benchmark range (GLFC 2021). But as previously stated, the Technical Fisheries Committee utilizes the most up-to-date and best information available to set harvest levels in Michigan waters of Lake Michigan; thus, management targets that have been defined are considered appropriate.

The state-licensed lake whitefish trap net fishery is additionally managed under the Lake Michigan Fisheries Management Plan established by the Michigan Department of Natural Resources (MDNR 2018). This plan defines the Michigan Department of Natural Resources Fisheries Division's near- and long-term goals and objectives for Lake Michigan fisheries and was developed through various engagement with a wide range of stakeholders (MDNR 2018). Relevant goals and objectives include but are not limited to: (1) healthy aquatic ecosystems and sustainable fish populations; (2) conserve, rehabilitate, and manage desirable aquatic species and their habitats; (3) develop, refine, and implement stock assessment models and tools for intensively managed species; (4) evaluate fisheries management actions and annually report on the status of key fisheries in Lake Michigan; and (5) monitor and encourage the success of native species remaining in the Lake Michigan Basin (MDNR 2018).

Therefore, because more than 70% of the fishery's main targeted and retained stocks have effective and appropriate management targets defined and precautionary policies are in place that are based on scientific advice, a score of highly effective is awarded for management strategy and implementation.

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Moderately Effective

The main targeted species in the Michigan tribal-licensed trap net fishery is lake whitefish; however, lake trout and walleye are also retained in this fishery. Therefore, the management strategy and implementation of lake whitefish, lake trout, and walleye is considered here.

Lake Whitefish

Tribal-licensed trap net lake whitefish management includes limited entry, establishment of commercial fishing zones, restricted zones, gear restrictions, size restrictions, establishment of seasonal spawning closures, and setting harvest control rules (CORA 2019)(CORA 2022b)(United States v. Michigan 2023)(GLFC 2021). For example, all commercial tribal-licensed trap net fishing and retention of lake whitefish is prohibited from November 6 at noon to November 29 at noon to protect lake whitefish spawning (CORA 2019)(CORA 2022b). Lake whitefish smaller than 17 inches must be returned to the water, if alive, and possession of 50 lbs round weight of undersized lake whitefish is prohibited (CORA 2019)(CORA 2022b). In the Lake Michigan Southern Development Zone, four tribal trap net operations are permitted, but must not exceed 12 nets each (CORA 2019)(CORA 2022b).

Lake whitefish harvest limits established by the 2023 Great Lakes Decree include the determination of spatial statistical districts and boundaries (United States v. Michigan 2023). Therefore, harvest limits are set for each management unit to allow for appropriate biological monitoring and assessment of lake whitefish populations. The Modeling Subcommittee calculates lake whitefish harvest limits by utilizing the target mortality rates established by the Decree (United States v. Michigan 2023). The Technical Fisheries Committee conducts statistical catch-at-age analysis models that are used to estimate abundance of lake whitefish in the 1836 Treaty waters of Lake Michigan as they are assessed by the 2023 Great Lakes Decree Modeling Subcommittee (United States v. Michigan 2023). Lake whitefish target reference points are established, and harvest limits are set in accordance with the terms of the 2023 Great Lakes Decree (United States v. Michigan 2023). The target annual mortality rates used to calculate the lake whitefish harvest limits are reviewed and evaluated by the Technical Fisheries Committee at least every 6 years beginning in 2028 (United States v. Michigan 2023). Harvest limits are set in place and held constant for lake whitefish for three consecutive years (e.g., lake whitefish monitoring occurs in 2024 to establish harvest limits for 2025, 2026, and 2027) (United States v. Michigan 2023).

Also, in lake whitefish management units that are not shared between the state and tribes, the Biological Service Division of CORA establishes, evaluates, and adjusts the benchmark harvest levels for lake whitefish (known as harvest regulation guidelines, HRGs) (CORA 2019)(CORA 2022a). The tribes must notify the Technical Fisheries Commission within two weeks of development (CORA 2019) (CORA 2022a). The 2023 Great Lakes Decree additionally requires the tribes to adopt and use an Electronic Reporting System for the collection, reporting, and sharing of information regarding commercial harvest of lake whitefish in the Lake Michigan (CORA 2019)(CORA 2022a).

Further, one specific lake whitefish FCO was developed by the Lake Michigan Committee, which was to maintain self-sustaining stocks of lake whitefish, round whitefish, sturgeon, suckers, and burbot, and the expected annual yield of lake whitefish should be 1.8–2.7 million kg (Eshenroder et al. 1995) (GLFC 2021). According to the most recent State of the Lake Michigan report, in the current reporting period (2016–21), the average annual commercial yield was less than 1.4 million kg (which does not

achieve the objective) (GLFC 2021). In addition, the most recent State of the Lake Michigan report highlighted that, from a lake-wide perspective, lake whitefish populations are currently unable to support fishery yields in the benchmark range (GLFC 2021).

Lake Trout

Tribal-licensed trap net lake trout management includes limited entry, establishment of commercial fishing zones, restricted zones, gear restrictions, size restrictions, establishment of seasonal spawning closures, and setting harvest control rules (CORA 2019)(CORA 2022b)(United States v. Michigan 2023)(GLFC 2021). For example, fishers from specific tribes are limited to 400 lbs round weight of lake trout per vessel per day caught within specific grids of Lake Michigan (CORA 2019)(CORA 2022b). All commercial tribal-licensed trap net fishing and retention of lake trout is prohibited from November 6 at noon to November 29 at noon to protect lake trout spawning (CORA 2019)(CORA 2022b). Two lake trout refuges are established in Lake Michigan where retention of lake trout is prohibited (CORA 2019)(CORA 2022b). Lake trout bag limits may not exceed 100 lbs round weight per vessel per day in some, but not all, management units, and lake trout smaller than 17 inches may not be retained (CORA 2019)(CORA 2022b).

Lake trout harvest limits established by the 2023 Great Lakes Decree include the determination of spatial statistical districts and boundaries (e.g., MM-1, MM-2, and MM-3 are combined as MM-123 for management purposes) (United States v. Michigan 2023). Therefore, harvest limits are set for each management unit to allow for appropriate biological monitoring and assessment of lake trout populations. The Modeling Subcommittee calculates lake trout harvest limits by utilizing the target mortality rates established by the Decree (United States v. Michigan 2023). The Technical Fisheries Committee conducts statistical catch-at-age analysis models that are used to estimate the abundance of lake trout in the 1836 Treaty waters of Lake Michigan as they are assessed by the 2023 Great Lakes Decree Modeling Subcommittee (United States v. Michigan 2023). Target reference points are established, and harvest limits are set in accordance with the terms of the 2023 Great Lakes Decree (United States v. Michigan 2023). The target annual mortality rates used to calculate the harvest limits are reviewed and evaluated by the Technical Fisheries Committee at least every 6 years beginning in 2028 (United States v. Michigan 2023). Harvest limits are set in place and held constant for lake trout for 3 consecutive years (e.g., lake trout monitoring occurs in 2023 to establish harvest limits for 2024, 2025, and 2026) (United States v. Michigan 2023). In addition, recent lake trout mortality in some management units was above the target rate and has been above the target reference point for almost every year of the previous 2000 Consent Decree (MSC 2022). The Decree further requires that the tribes adopt and use an Electronic Reporting System for the collection, reporting, and sharing of information regarding the commercial harvest of lake trout in Lake Michigan (MSC 2022).

Further, two specific lake trout FCOs were developed: (1) establish a diverse salmonine community capable of sustaining an annual harvest of 2.7 to 6.8 million kg, of which 20–25% is lake trout, and (2) establish self-sustaining lake trout populations (Eshenroder et al. 1995)(GLFC 2021). The purposes of these two objectives are to maintain a diverse fishery for lake trout and salmon and to foster rehabilitation of wild lake trout populations (Eshenroder et al. 1995)(GLFC 2021). According to the Lake Trout Working Group's most recent report in 2021, the first FCO was not met because the total salmon and trout harvest was below the FCO threshold for the seventh consecutive year (2.51 million kg) and lake trout made up 32.3% of the total salmonid harvest (LMLTWG 2021). This higher percentage is mainly the result of reduced salmon harvest, because the lake trout harvest has

remained stable through the time series (LMLTWG 2021). Regarding the second FCO, data suggest conflicting trajectories and conclusions for current lake trout restoration (LMLTWG 2021).

Walleye

Tribal-license trap net walleye management includes the establishment of commercial and restricted fishing zones, gear restrictions, size restrictions, and establishment of seasonal spawning closures (CORA 2019)(CORA 2022b)(United States v. Michigan 2023)(GLFC 2021). For example, to protect walleye spawning stocks, in areas where commercial fishing is permitted, except under special circumstances, fishing for walleye is prohibited during the period from noon March 15 through noon May 1 in Lake Michigan (CORA 2019). Walleye less than 15 inches caught in trap nets must be returned to the water dead or alive (CORA 2019)(CORA 2022b). No undersized walleye is permitted for sale (CORA 2019)(CORA 2022b). Walleye shall be monitored by the state and the tribes through appropriate collection of biological data from all fisheries (recreational, subsistence, and commercial) (CORA 2019)(CORA 2022b). But no stock assessment models or biological reference points are used to determine the status of the walleye, and fishing mortality is considered unknown.

One specific walleye FCO was developed, which was to maintain self-sustaining stocks of yellow perch, walleye, smallmouth bass, pike, catfish, and panfish, and the expected annual yield for walleye should be 0.2 to 0.4 million lbs (Eshenroder et al. 1995)(GLFC 2021). The average walleye yield during the most recent State of the Lake reporting period (2016–21) was 0.35 million lbs (GLFC 2021). In addition, walleye yield has been at or above the target range in 14 of the past 15 reporting years (2007–21) (GLFC 2021). But according to the Harvest of Fishes report in Lake Michigan, the total walleye harvest (commercial, sport, weir, assessment, and incidental catch) was above this FCO in 2021 and 2022, because there has been an increasing trend in walleye harvest lake-wide in recent years (Redman 2023).

Therefore, because more than 70% of the fishery's main targeted and retained stocks have measures in place that are expected to be effective, but there is a potential need for increased precaution (e.g., lake trout mortality has exceeded the target rate in recent years and no stock assessments or biological reference points have been established for walleye), a score of moderately effective is awarded for management strategy and implementation.

**Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary
uncovered pound nets**

Highly effective

Wisconsin state-licensed trap net, gillnet, and bottom trawl lake whitefish management includes limited entry, establishment of commercial fishing zones, restricted zones, gear restrictions, size restrictions, closed seasons, and setting harvest control rules (LMFMT 2017)(WDNR 2022d)(Wisconsin Natural Resources Board 2015). For example, no lake whitefish smaller than 17 inches may be possessed or under control in Green Bay and Lake Michigan (WDNR 2022d). No fisher may take, catch, or kill lake whitefish in the entire month of November (WDNR 2022d). The commercial state-licensed lake whitefish harvest in Wisconsin waters is regulated using quotas on a calendar year basis (WDNR 2022a)(WDNR 2023). Quotas and the total allowable annual commercial harvest levels are regularly adjusted in response to changes in the stock biomass and are approved by the Natural Resource

Board, based on recommendations from the Bureau of Fisheries Management (LMFMT 2017)(WDNR 2022a)(WDNR 2023). The recommendations are based upon the best information available (e.g., time series databases and fisheries-independent biological surveys) with the intent of supporting a viable and sustainable commercial harvest (LMFMT 2017).

The Wisconsin Department of Natural Resources utilizes the Green Bay lake whitefish population statistical catch-at-age analysis model to set the total allowable commercial harvest in Green Bay, and utilizes the Lake Michigan lake whitefish population statistical catch-at-age analysis model to set the total allowable commercial harvest in Lake Michigan (WDNR 2023). One specific lake whitefish FCO was developed by the Lake Michigan Committee, which was to maintain self-sustaining stocks of lake whitefish, round whitefish, sturgeon, suckers, and burbot, and the expected annual yield of lake whitefish should be 1.8–2.7 million kg (Eshenroder et al. 1995)(GLFC 2021). According to the most recent State of the Lake Michigan report, in the current reporting period (2016–21), the average annual commercial yield was less than 1.4 million kg (which does not achieve the objective) (GLFC 2021). In addition, the most recent State of the Lake Michigan report highlighted that, from a lake-wide perspective, lake whitefish populations are currently unable to support fishery yields in the benchmark range (GLFC 2021). But, as previously stated, WDNR utilizes the most up-to-date and best information available to set the total allowable annual commercial harvest levels in Wisconsin waters of Lake Michigan; thus, management targets that have been defined are considered appropriate.

Lake whitefish in Wisconsin waters is primarily managed under the Lake Michigan Integrated Fisheries Management Plan (LMFMT 2017). The plan is structured under five broad Lake Michigan fishery visions: (1) a diverse, balanced, and healthy ecosystem, (2) a diverse multispecies sport fishery, (3) a sustainable and viable commercial fishery, (4) science-based management, and (5) effective internal and external communication (LMFMT 2017). Specific to vision 3, Wisconsin commercial fisheries management is built upon three principles: (1) annual harvest limits, (2) limited entry, and (3) individual transferable quotas (LMFMT 2017). Following the recommendation of the National Research Council's Committee on Ecosystem Management for Sustainable Marine Fisheries, a precautionary approach is used when setting harvest limits, and these are based on the current status of the lake whitefish population (LMFMT 2017). The purpose of the limited entry system is to stabilize the fishery by protecting the fishers from unrestrained competition (LMFMT 2017). The individual transferable quota system is set in place, which allows the harvest limit for lake whitefish to be divided among license holders on a percentage basis (LMFMT 2017). The purpose is to assure that a portion of the total harvest limit is reserved for each license holder, and it eliminates the need for fishers to race to harvest the largest possible portion of the total allowable harvest for that year (LMFMT 2017).

Therefore, because more than 70% of the fishery's main targeted and retained stocks have effective and appropriate management targets defined, and precautionary policies are in place that are based on scientific advice, a score of highly effective is awarded for management strategy and implementation.

Factor 3.2 - Bycatch Strategy

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Highly effective

There are no bycatch species and no other main species discarded (>5% of the catch) in any of the fisheries assessed in this report (Michigan tribal-licensed trap net and gillnet walleye, lake whitefish, and lake trout fisheries; Michigan state-licensed trap net lake whitefish fishery; Wisconsin state-licensed bottom trawl, trap net, and gillnet lake whitefish fisheries). Lake sturgeon is the only species of concern that interacts with these fisheries; however, catch of lake sturgeon in these fisheries is considered negligible per the Seafood Watch Fisheries Standard. Also, the fishing methods utilized in Lake Michigan (gillnets, trap nets, and bottom trawls) are not believed to have significant impacts on lake sturgeon, and most fish that are incidentally caught with such gears are returned to the water alive (Hayes and Caroffino 2012)(Seilheimer 2023, pers comm). Therefore, because the gear used are highly selective, the bycatch strategy is scored highly effective.

Factor 3.3 - Scientific Data Collection and Analysis

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Moderately Effective

The Technical Fisheries Committee and CORA use the results from the Modeling Subcommittee's lake whitefish and lake trout stock assessments to inform the management strategy for the lake whitefish and lake trout tribal-licensed gillnet and trap net fisheries (MSC 2022). The lake whitefish SCAA models utilize only fishery-dependent information; therefore, abundance estimates for recent cohorts remain uncertain (MSC 2022). Fishing mortality sources for the lake whitefish assessment only include commercial and natural mortality. Additional challenges to the lake whitefish stock assessment include a potential mismatch between the biological stock and management unit boundaries, small-scale fisheries, and limited monitoring information (MSC 2022). Despite these challenges, the best available data and consistent model structures are used across all management units (MSC 2022). The lake trout stock assessment is up-to-date, peer-reviewed, and independent. The lake trout SCAA models utilize both fishery-independent and fishery-dependent information (MSC 2022). All relevant sources of fishing mortality are incorporated into the assessment, including recreational, commercial, natural, and lamprey mortality (MSC 2022). Lake trout assessments are supported by well-established agency survey indices (MSC 2022). Recommendations for total annual harvest limits for lake whitefish and lake trout are adjusted based on the best available information. Per the Decree of 2023, lake

whitefish stock assessments will henceforth be conducted once every 3 years (United States v. Michigan 2023). No stock assessments are conducted for walleye in the Michigan waters of Lake Michigan. Instead, the Lake Michigan Committee utilizes the results of the annual Harvest of Fishes report to inform walleye abundance and health (Redman 2023). Harvest data include commercial, sport, weir, assessment, and incidental catch (Redman 2023).

Although no bycatch studies or published reports have been completed for the lake whitefish, lake trout, and walleye tribal gillnet and trap net fisheries, bycatch is appropriately monitored by the Tribes, and nets are set at times, locations, and depths where bycatch is rare (Caroffino 2023, pers comm) (CORA 2022a)(CORA 2022b). Further, there is a lack of observer coverage and a lack of data of ghost fishing impacts in the fisheries. Therefore, because some data related to stock abundance and health are collected and analyzed, but data are not sufficient to meet a highly effective score (e.g., not including fishery-independent information, uncertainty in monitoring and stock boundaries, and a lack of independent stock assessment for walleye), scientific data collection and analysis is scored moderately effective for the lake whitefish, lake trout, and walleye tribal-licensed gillnet and trap net fisheries.

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Moderately Effective

The Technical Fisheries Committee uses the results from the Modeling Subcommittee's lake whitefish data-limited stock assessment to inform the management strategy for the state-licensed lake whitefish trap net fishery (MSC 2022). The SCAA models utilize only fishery-dependent information; therefore, abundance estimates for recent cohorts remain uncertain (MSC 2022). Fishing mortality sources only include commercial and natural mortality. Additional challenges to the stock assessment include a potential mismatch between the biological stock and management unit boundaries, small scale fisheries, and limited monitoring information (MSC 2022). Despite these challenges, the best available data and consistent model structures are used across all management units (MSC 2022). Thus, recommendations for total annual harvest limits are adjusted based on the best available information. Although no bycatch studies or published reports have been completed for the lake whitefish state fishery, bycatch is appropriately monitored. For the Michigan lake whitefish state-licensed fishery, discards are reported to the management agency (Caroffino 2023, pers comm)(Gonia 2023, pers comm). But, there is a lack of observer coverage and a lack of data of ghost fishing impacts in the fishery. Therefore, because some data related to stock abundance and health are collected and analyzed, but data are not sufficient to meet a highly effective score (e.g., not including fishery-independent information and uncertainty in monitoring and stock boundaries), scientific data collection and analysis is scored moderately effective for the lake whitefish state-licensed trap net fishery.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls

Highly effective

The Wisconsin Department of Natural Resources uses the results from the Lake Michigan population and Green Bay population SCAA models to inform the management strategy for the state commercial fisheries (WDNR 2023). The stock assessment is up-to-date, independent, and robust. The SCAA models utilize both fishery-dependent and fishery-independent information (WDNR 2023)(Hansen 2023, pers comm). Relevant sources of fishing mortality are incorporated into the assessment,

including natural, recreational, sport ice fishery, and commercial fishery (WDNR 2023). Quotas and harvest levels are regularly adjusted in response to changes in the stock biomass and are set by the Natural Resource Board based on recommendations from the Bureau of Fisheries Management and the SCAA models (LMFMT 2017)(WDNR 2022a)(WDNR 2023). The total allowable catch and quota recommendations are set every 3 years, with the most recent quota established utilizing data through 2021 (WDNR 2023). Bycatch is appropriately monitored through various bycatch studies on the bottom trawl fishery (Seilheimer 2019). In addition, there is adequate onboard video monitoring in the bottom trawl fishery that is sufficient to ensure that goals are being met for bycatch and retained species (Wisconsin Natural Resources Board 2015). Therefore, scientific data collection and analysis for the Wisconsin lake whitefish bottom trawl fishery has been scored highly effective.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets

Moderately Effective

The Wisconsin Department of Natural Resources uses the results from the Lake Michigan population and Green Bay population SCAA models to inform the management strategy for the state commercial fisheries (WDNR 2023). The stock assessment is up-to-date, independent, and robust. The SCAA models utilize both fishery-dependent and fishery-independent information (WDNR 2023)(Hansen 2023, pers comm). Relevant sources of fishing mortality are incorporated into the assessment, including natural, sport ice fishery, and commercial fishery (WDNR 2023). Quotas and harvest levels are regularly adjusted in response to changes in the stock biomass and are set by the Natural Resource Board based on recommendations from the Bureau of Fisheries Management and the SCAA models (LMFMT 2017)(WDNR 2022a)(WDNR 2023). Total allowable catch and quota recommendations are set every 3 years, with the most recent quota established utilizing data through 2021 (WDNR 2023). Bycatch is appropriately monitored through various bycatch studies on the trap net and gillnet fisheries (Hrabak 2022). But, there is a lack of observer coverage or video monitoring to ensure that goals are being met for both bycatch and retained species, and a lack of data on ghost fishing impacts by the fishery (WDNR 2022d). Therefore, scientific data collection and analysis has been scored moderately effective for the Wisconsin lake whitefish trap net and gillnet fisheries.

Factor 3.4 - Enforcement of and Compliance with Management Regulations

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Highly effective

The Great Lakes Law Enforcement Committee was created by the Great Lakes Fishery Commission through the multijurisdictional Joint Strategic Plan for Management of Great Lakes Fisheries to protect, enhance, and promote the safe and wise use of natural resources in the Great Lakes (GLFC 2014) (GLFC 2022c)(GLFC 2023d)(GLFC 2023e). The Law Enforcement Committee comprises members from all representative state, tribal, and provincial agencies, and serves as a channel between law enforcement agencies and their respective fishery managers (GLFC 2014)(GLFC 2022c)(GLFC 2023d)(GLFC 2023e). The Law Enforcement Committee is responsible for a range of issues, such as supporting investigations that cross jurisdictional lines, developing consistent regulations and commensurate penalties among jurisdictions, providing necessary leadership to bring resolution to law enforcement issues, providing annual basin updates, and organizing training sessions for Great Lakes officers on everything from invasive species identification to information sharing (GLFC 2014)(GLFC 2022c)(GLFC 2023d)(GLFC 2023e). Great Lakes officers, who work through the Law Enforcement Committee, engage in covert operations to protect resources from illegal harvest, invasive species, and other threats (GLFC 2014)(GLFC 2022c)(GLFC 2023d)(GLFC 2023e). Tribal, federal, and state law enforcement and conservation officers undergo and utilize various techniques to enforce regulations, such as advanced surveillance, forensic fish analysis, joint patrols, tip lines, and stake-outs (GLFC 2014)(GLFC 2022c)(GLFC 2023d)(CORA 2019)(CORA 2023b)(MDNR 2019)(MDNR 2020) (WDNR 2022b)(WDNR 2022c). Commercial fishing vessels can be boarded for harvest and gear inspection (GLFC 2014)(GLFC 2022c)(GLFC 2023d)(CORA 2019)(CORA 2023b)(MDNR 2019) (MDNR 2020)(WDNR 2022b)(WDNR 2022c). Portside inspections are used to enforce regulations such as minimum fish sizes, retention of prohibited species, and gear restrictions (GLFC 2014)(GLFC 2022c)(GLFC 2023d)(CORA 2019)(CORA 2023b)(MDNR 2019)(MDNR 2020)(WDNR 2022b) (WDNR 2022c). Deployed gear is randomly inspected to examine gear placement, mesh size, and markings (GLFC 2014)(GLFC 2022c)(GLFC 2023d)(CORA 2019)(CORA 2023b)(MDNR 2019) (MDNR 2020)(WDNR 2022b)(WDNR 2022c). Because regulations are independently verified with the capacity to control and report compliance at a scale appropriate for the fisheries, enforcement of and compliance with management regulations is rated highly effective.

Factor 3.5 - Stakeholder Inclusion

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Highly effective

The GLFC includes stakeholder input in the development of legislation, harvest restrictions, and enforcement regulations (GLFC 2007)(GLFC 2023a)(GLFC 2023f)(GLFC 2023g). The GLFC holds annual meetings where the public can learn about and discuss developments in the Great Lakes fishery (GLFC 2023g). Each lake has a representative committee that is required to make regular reports to the Council of Lake Committees (GLFC 2007)(GLFC 2023a). These reports generate the development of new legislation, which is made public, and local, state, provincial, tribal, and federal agencies are invited to submit comments and suggestions (GLFC 2007)(GLFC 2023a). Also, the lake committees hold annual meetings that are open to the public to review progress toward fishery

objectives, as well as a common session to discuss topics of interest to the entire basin (GLFC 2023g).

One of the main goals of the Tribes is to maintain and build upon cooperative intergovernmental structures and activities (CORA 2022b). To that end, the Tribes, through CORA, actively participate in all information sharing and consultation entities (CORA 2022b). In addition, members of the Tribes and the Michigan Department of Natural Resources are integral members of the Lake Michigan committee and the Technical Fisheries Committee (CORA 2022b)(United States v. Michigan 2023). Further, the 2023 Great Lakes Decree establishes a mechanism to effectively address user conflicts and encourages high participation in the assessment and management process (United States v. Michigan 2023).

Because the management process is transparent and includes stakeholder input from major user groups, provides forums to address conflict, and encourages participation in the assessment and management process, with a constructive relationship between management, scientists, and fishers, stakeholder inclusion is rated highly effective.

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Highly effective

The GLFC includes stakeholder input in the development of legislation, harvest restrictions, and enforcement regulations (GLFC 2007)(GLFC 2023a)(GLFC 2023f)(GLFC 2023g). The GLFC holds annual meetings where the public can learn about and discuss developments in the Great Lakes fishery (GLFC 2023g). Each lake has a representative committee that is required to make regular reports to the Council of Lake Committees (GLFC 2007)(GLFC 2023a). These reports generate the development of new legislation, which is made public, and local, state, provincial, tribal, and federal agencies are invited to submit comments and suggestions (GLFC 2007)(GLFC 2023a). Also, the lake committees hold annual meetings that are open to the public to review progress toward fishery objectives, as well as a common session to discuss topics of interest to the entire basin (GLFC 2023g).

The 2023 Great Lakes Decree establishes a mechanism to effectively address user conflicts and encourages high participation in the assessment and management process (United States v. Michigan 2023). Specific to the Michigan Department of Natural Resources Fisheries Division, transparency, collaboration, and communication in decision making are core values of the department (MDNR 2018). Thus, a broad array of stakeholders were involved in the development of the Michigan Department of Natural Resources Lake Michigan Fisheries Management Plan (MDNR 2018). Specifically, in developing the management plan, a Great Lakes Management Angler Survey was conducted to assess angler opinions toward management, and five focus groups representing anglers, commercial fishers, tribes, business owners, and community leaders provided feedback on Lake Michigan aquatic resources-related threats and opportunities (MDNR 2018). Further, the management plan is reviewed annually by the Michigan Department of Natural Resources Fisheries Division staff, the Lake Michigan Citizen's Fishery Advisory Committee, and broader regional focus groups (MDNR 2018).

Because the management process is transparent and includes stakeholder input from major user

groups, provides forums to address conflict, and encourages participation in the assessment and management process, with a constructive relationship between management, scientists, and fishers, stakeholder inclusion is rated highly effective.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets

Highly effective

The GLFC includes stakeholder input in the development of legislation, harvest restrictions, and enforcement regulations (GLFC 2007)(GLFC 2023a)(GLFC 2023f)(GLFC 2023g). The GLFC holds annual meetings where the public can learn about and discuss developments in the Great Lakes fisheries (GLFC 2023g). Each lake has a representative committee that is required to make regular reports to the Council of Lake Committees (GLFC 2007)(GLFC 2023a). These reports generate the development of new legislation, which is made public, and local, state, provincial, and federal agencies are invited to submit comments and suggestions (GLFC 2007)(GLFC 2023a). Also, the lake committees hold annual meetings that are open to the public to review progress toward fishery objectives, as well as a common session to discuss topics of interest to the entire basin (GLFC 2023g).

The Wisconsin Department of Natural Resources Lake Michigan Integrated Fisheries Management Plan includes effective internal and external communication as one of its broad five fishery visions, recognizing the importance of fostering an open dialog with the interested public, political leaders, and sister agencies' goals (LMFMT 2017). Public involvement and feedback was also included and incorporated during all stages of the management plan, from draft to finalization (LMFMT 2017). The goal of maintaining a full and open exchange of information and ideas with the public is achieved under three objectives: (1) continually improving the methods to communicate information to stakeholders through various media, such as forums (e.g., The Lake Michigan Fisheries Forum (WDNR 2012)), email, webpage, publications, and outreach events; (2) engaging stakeholders to determine their fishery preferences, desires, perceptions, and experiences through various means such as updating said management plan every 10 years to include public input and a formal review and comment process, holding public meetings, and utilizing various survey methods; and (3) communicating the survey results and management project results with the public and scientific community by requiring standard reporting protocols, providing formal reports and publications through the website, and presenting at conferences and forums (LMFMT 2017).

Because the management process is transparent and includes stakeholder input from major user groups, provides forums to address conflict, and encourages participation in the assessment and management process, with a constructive relationship between management, scientists, and fishers, stakeholder inclusion is rated highly effective.

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery’s overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- **Score >3.2=Green or Low Concern**
- **Score >2.2 and ≤3.2=Yellow or Moderate Concern**
- **Score ≤2.2 = Red or High Concern**

Guiding principles

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	FORAGE SPECIES?	SCORE
Lake Michigan America, North - Inland Waters United States Set gillnets Tribal fishery	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets	Score: 3	Score: 0	Low Concern		Green (3.464)
Lake Michigan America, North - Inland Waters United States Stationary uncovered pound nets Tribal fishery	Score: 3	Score: 0	Moderate Concern		Yellow (3.000)
Lake Michigan America, North - Inland Waters United States Wisconsin Bottom trawls	Score: 2	Score: 0	Low Concern		Yellow (2.828)
Lake Michigan America, North - Inland Waters United States Wisconsin Set gillnets	Score: 3	Score: 0	Low Concern		Green (3.464)
Lake Michigan America, North - Inland Waters United States Wisconsin Stationary uncovered pound nets	Score: 3	Score: 0	Low Concern		Green (3.464)

The Great Lakes Fishery Commission implements an ecosystem-management strategy as one of its four main strategies for Great Lakes fishery management (GLFC 2007). Specifically, the Joint Strategic Plan for Management of Great Lakes Fisheries states that “all parties must exercise their full authority and influence in every available arena to meet the biological, chemical, and physical needs of desired fish communities” (GLFC 2007). Agencies must address the potential impacts of overlapping activities and decisions to be able to coordinate fishery and environmental needs and objectives, such as through the creation of Lakewide Action and Management Plans (LAMP) (GLFC 2007)(EPA 2021). The Lake Michigan LAMP is an ecosystem-based strategy intended to protect and restore Lake Michigan’s water quality, with a focus on restoring and protecting habitat and species (EPA 2021). In the most current Lake Michigan LAMP, various projects are underway to improve aquatic habitat connectivity and quality, such as a multiyear effort to protect and restore important fisheries reefs that are critical spawning areas for many fish species including lake trout, lake whitefish, and walleye (EPA 2021). This specific project includes collaborators from the U.S. Fish and Wildlife Service, U.S. Geological Survey, Michigan Department of Natural Resources, Wisconsin Department of Natural Resources, the Lake Michigan Committee, the Nature Conservancy, and CORA (EPA 2021). The status of fish stocks and ecosystems, current management efforts, and future recommendations for Lake Michigan are detailed in the most recent State of Lake Michigan Report, which integrates a current action item to increase coordination with other environmental organizations to promote further ecosystem-based management through a multidisciplinary approach (GLFC 2021).

More specifically, ecosystem-based fisheries management began to be recognized because of its importance in lake trout rehabilitation, which has been occurring in Lake Michigan since the early 1960s (Dexter et al. 2011)(LMLTWG 2021). Ecological interactions existing between lake trout and its surrounding ecosystem are a subject of great concern and consideration for managers throughout the Great Lakes. A basin-wide rehabilitation effort is currently underway that attempts to fully understand lake trout’s ecological role, to help restore the stocks (Dexter et al. 2011)(LMLTWG 2021). Also, the Lake Michigan ecosystem contains an assemblage of exotic species including sea lamprey, round goby, dreissenids, and spiny water fleas, which have dramatically altered energy pathways throughout the ecosystem (GLFC 2021). The proliferation of these species is linked to declines in growth, abundance, and condition of several species of fish in Lake Michigan and is suspected of causing the reduction of lake whitefish recruitment throughout the lake (GLFC 2021). Overall, invasive and exotic species continue to be the primary impediment to achievement of most of Lake Michigan’s FCOs (GLFC 2021); therefore, even with strong management strategies in place, populations of native species (such as lake trout) cannot be restored to pre-fishery and pre-lamprey levels, and recovery should proceed in the context of re-establishment (GLFC 2021)(Zimmerman and Krueger 2009)

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to*

commonly contact the bottom.

- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0—No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management

Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*

- 1 — *Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery

Score: 3

Commercial tribal fishers utilize large mesh gillnets to capture walleye, lake whitefish, and lake trout in Lake Michigan (Figure 36) (CORA 2023d). The gillnet has floats along the top and anchor weights on the bottom (CORA 2023d). A single net varies in depth from 6 to 20 feet and length from 100 to 400 feet (CORA 2023d). Large-mesh gillnets have a mesh of 4 to 5 inches stretched (CORA 2023d). Gillnets can be set in depths greater than 700 feet (CORA 2023d). Also, the bottom substrate of Lake Michigan comprises mostly sand (35.3%) and clay (32.5%), with 5% hard substrate (Figure 37) (Wang et al. 2015)(Esselman 2018). Therefore, the physical impact of large mesh gillnets (potentially due to deployment of anchors and lead line) on habitat, fished in Lake Michigan on muddy and sandy substrate, is scored a 3, following the Seafood Watch Fisheries Standard.

Justification:

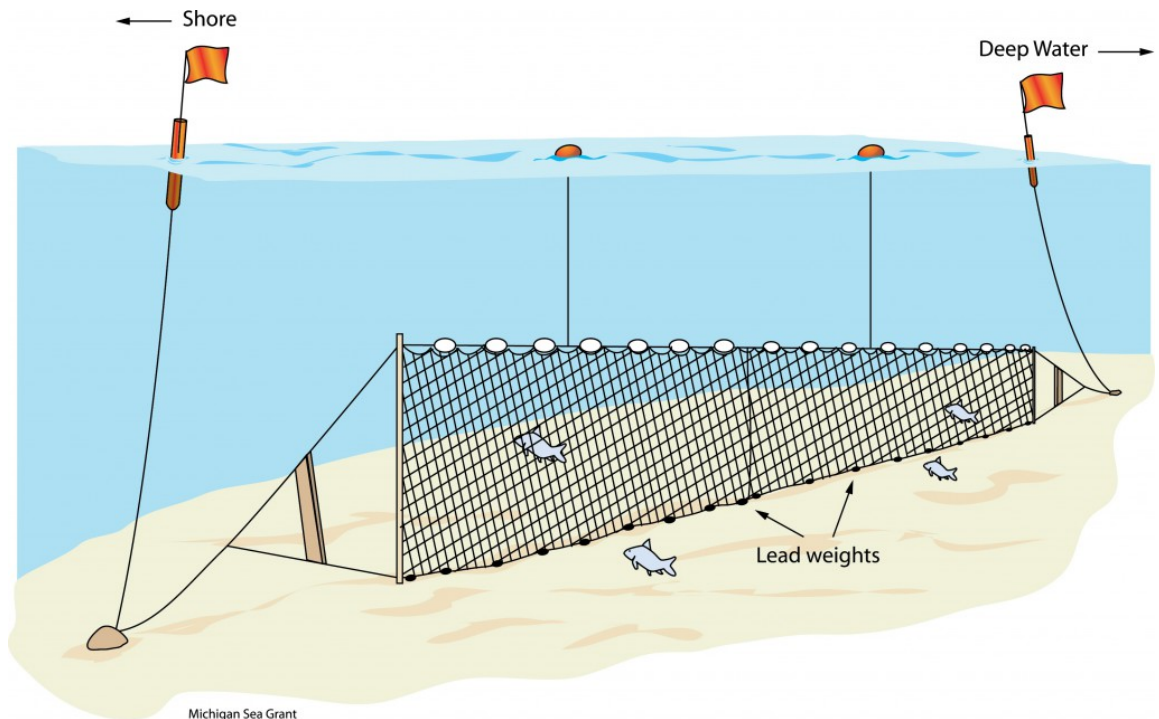


Figure 36: Commercial gillnet (Michigan Sea Grant 2023a).

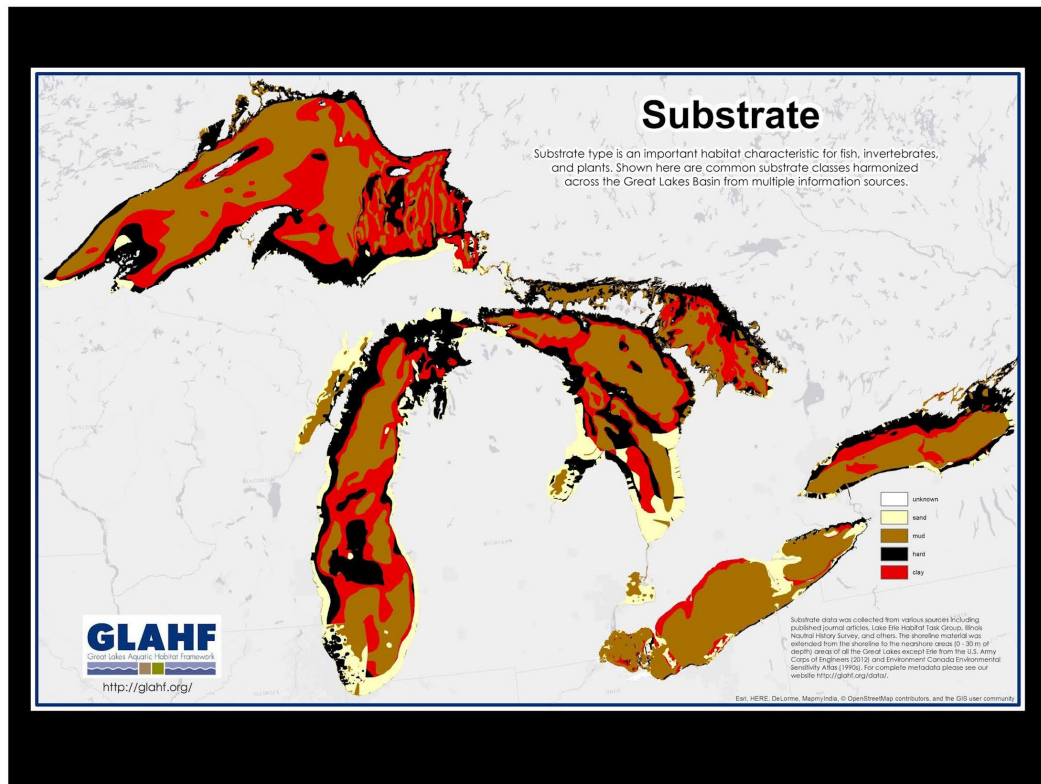


Figure 37: Map of substrate types in the Great Lakes (Esselman 2018).

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Score: 3

Michigan state commercial fishers utilize trap nets to capture lake whitefish in Lake Michigan (Figure 38) (Michigan Sea Grant 2023b). The net has a 1,000-ft, 14-in stretch mesh lead, and submerged closed-top hearts and pots that are supported by floats, frames, and anchors (Michigan Sea Grant 2023b). The trap nets are used in waters no deeper than 90 ft and have a flag marker buoy or floats at both the lead end and the anchor end (Michigan Sea Grant 2023b). Also, the bottom substrate of Lake Michigan comprises mostly sand (35.3%) and clay (32.5%), with 5% hard substrate (see Figure 37) (Wang et al. 2015)(Esselman 2018). Therefore, the physical impact of trap nets (potentially due to deployment of anchors and lead line) on habitat, fished in Lake Michigan on muddy and sandy substrate, is scored a 3, following the Seafood Watch Fisheries Standard.

Justification:

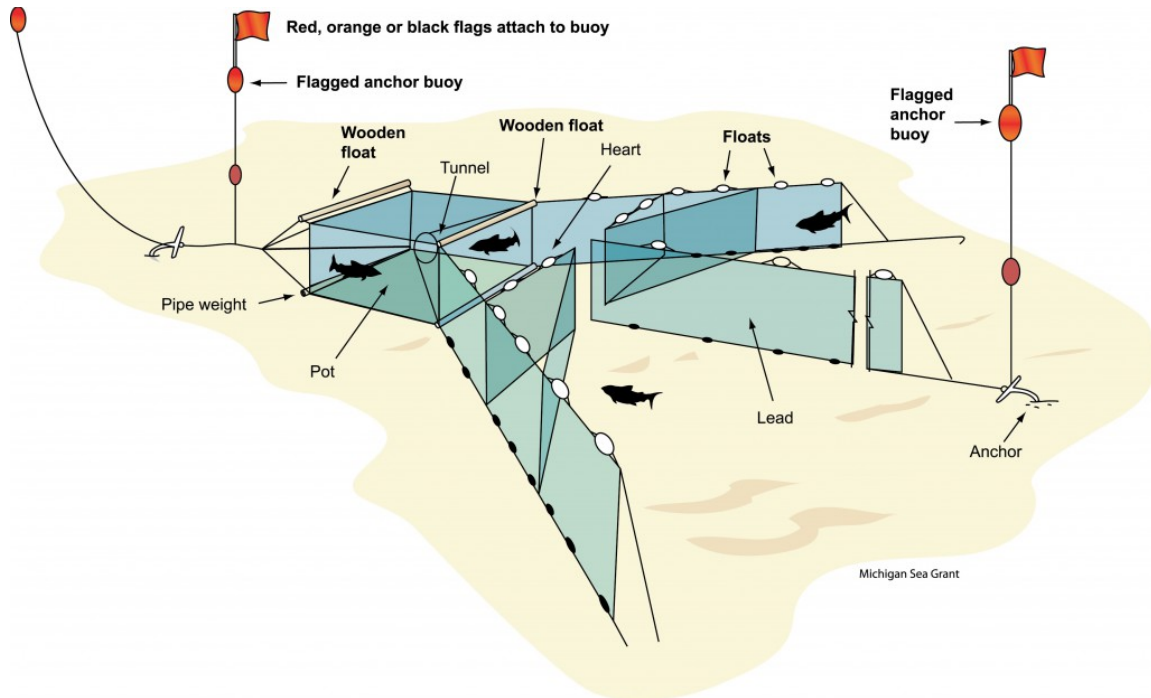


Figure 38: Commercial trap net (Michigan Sea Grant 2023a).

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Score: 3

Commercial tribal fishers utilize trap nets to capture walleye, lake whitefish, and lake trout in Lake Michigan (see Figure 38) (CORA 2023c). The net has a 1,000 foot, 14-inch stretch mesh lead and submerged closed-top hearts and pots that are supported by floats, frames, and anchors (CORA 2023c). The trap nets are used in waters no deeper than 90 ft and have a flag marker buoy or floats at both the lead end and the anchor end (CORA 2023c). Also, the bottom substrate of Lake Michigan comprises mostly sand (35.3%) and clay (32.5%), with 5% hard substrate (see Figure 37) (Wang et al. 2015)(Esselman 2018). Therefore, the physical impact of trap nets (potentially due to deployment of anchors and lead line) on habitat, fished in Lake Michigan on muddy and sandy substrate, is scored a 3, following the Seafood Watch Fisheries Standard.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls

Score: 2

Wisconsin state commercial fishers utilize bottom trawls to capture lake whitefish in Lake Michigan (Wisconsin Natural Resources Board 2015)(Stroess 2023, pers comm). Trawls consist of a head rope height no greater than 45 m and wing mesh no less than 4.5 in stretched (Wisconsin Natural Resources Board 2015)(Stroess 2023, pers comm). The single cod end of the trawl bag may not be less than 4.5 in stretched (Wisconsin Natural Resources Board 2015)(Stroess 2023, pers comm). The net is made of twine that is capable of remaining open under tension (Wisconsin Natural Resources Board 2015)(Stroess 2023, pers comm). Trawls may only be deployed for a maximum time of 1 hour (Wisconsin Natural Resources Board 2015)(Stroess 2023, pers comm). In addition, the bottom substrate of Lake Michigan comprises mostly sand (35.3%) and clay (32.5%), with 5% hard substrate

(see Figure 37) (Wang et al. 2015)(Esselman 2018). Therefore, the physical impact of bottom trawls on habitat, fished in Lake Michigan on muddy and sandy substrate, is scored a 2, following the Seafood Watch Fisheries Standard.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets

Score: 3

Wisconsin state commercial fishers utilize large mesh gillnets to capture lake whitefish in Green Bay and Lake Michigan (see Figure 36) (WDNR 2022d)(Stroess 2023, pers comm). Gillnets are marked on each end with a buoy, staff, and flag (WDNR 2022d)(Stroess 2023, pers comm). The gillnet has floats along the top and anchor weights on the bottom (WDNR 2022d)(Stroess 2023, pers comm). A single net varies in depth from 4 to 14 ft and is normally up to 2,000 ft long (WDNR 2022d)(Stroess 2023, pers comm). Gillnets have a mesh ranging from 1.5 to 5 in stretched (WDNR 2022d)(Stroess 2023, pers comm). Also, the bottom substrate of Lake Michigan comprises mostly sand (35.3%) and clay (32.5%), with 5% hard substrate (see Figure 37) (Wang et al. 2015)(Esselman 2018). Therefore, the physical impact of gillnets (potentially due to deployment of anchors and lead line) on habitat, fished in Lake Michigan on muddy and sandy substrate, is scored a 3, following the Seafood Watch Fisheries Standard.

Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets

Score: 3

Wisconsin state commercial fishers utilize trap nets to capture lake whitefish in Green Bay and Lake Michigan (Figure 39) (Wisconsin Sea Grant 2023)(WDNR 2022d). The trap nets are marked with several flags, and anchor lines may extend beyond the flags 400-600 ft from the net (Wisconsin Sea Grant 2023)(WDNR 2022d). Trap nets are set at different depths throughout the season (early in the season, they may be set in water from 25 to 150 ft; between June 29 and Labor Day, they may be set in water from 60 to 150 ft), but the leads always extend toward the shore (Wisconsin Sea Grant 2023) (WDNR 2022d). The trap nets are anchored on the bottom and may be 45 ft high (Wisconsin Sea Grant 2023)(WDNR 2022d). Also, the bottom substrate of Lake Michigan comprises mostly sand (35.3%) and clay (32.5%), with 5% hard substrate (see Figure 37) (Wang et al. 2015)(Esselman 2018). Therefore, the physical impact of trap nets (potentially due to deployment of anchors and lead line) on habitat, fished in Lake Michigan on muddy and sandy substrate, is scored a 3, following the Seafood Watch Fisheries Standard.

Justification:

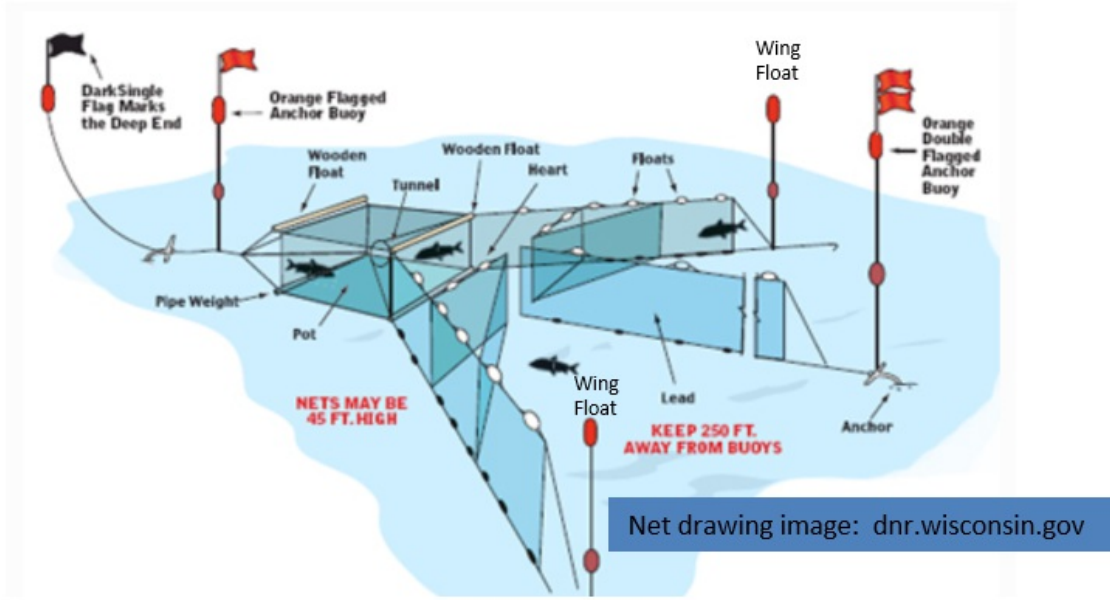


Figure 39: Wisconsin State commercial trap net (Wisconsin Sea Grant 2023).

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

- Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
- Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery
- Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls
- Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
- Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets
- Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Score: 0

The impacts of commercial fishing gear on benthic substrate have not been fully assessed in Lake Michigan. In the Michigan waters of Lake Michigan, there are two lake trout refuges (Northern Refuge: ≈4% of Lake Michigan's total surface area; Midlake Refuge: ≈5% of Lake Michigan's total surface area) where commercial and subsistence fishing with gillnets is prohibited (United States v. Michigan 2023)(LMLTWG 2021)(Lenart 2023, pers comm). But, commercial fishing with trap nets is permitted in the lake trout refuges, although retention of lake trout is prohibited (United States v. Michigan 2023)(LMLTWG 2021). Further, in 2021, NOAA designated a 962 square-mile area (≈4% of Lake Michigan's total surface area) as a national marine sanctuary known as the Wisconsin Shipwreck Coast National Marine Sanctuary (Michigan Sea Grant 2023b)(NOAA 2023). Therefore, spatial protections do not meet the requirements to apply a modifying score for mitigation of gear impacts, because less than 20% of the representative habitat is completely protected from fishing with gear types that impact the habitat of the fisheries.

Factor 4.3 - Ecosystem-based Fisheries Management

Lake Michigan | America, North - Inland Waters | United States | Set gillnets | Tribal fishery
Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets | Tribal fishery

Moderate Concern

Specific to CORA, the management objectives and goals of the Tribal Plan are centered around ecosystem-based management, as it is designed to protect the fisheries habitat and resource upon which the Tribes' rights depend (CORA 2022b). Specifically, one of the management objectives is to "pursue and support environmental activities that protect and enhance Great Lakes fish stocks and habitat as well as Tribal fisheries" (CORA 2022b).

Lake Trout

Effective temporal and spatial management is used because two lake trout refuges are established in Lake Michigan where harvest and retention of lake trout is prohibited year-round (LMLTWG 2021). Also, a Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan was established that encompasses comprehensive stocking strategies, harvest controls, and invasive species control, which take into account stocking and genetic impacts on the food web and ecosystem (LMLTWG 2021). In addition, HRGs are in place to manage the harvest limit of lake trout, which make up the tribal commercial catch in gillnets and trap nets set in 1836 Treaty-ceded Michigan waters (MSC 2022). Further, detrimental food web impacts from harvesting the species are unlikely, but are still possible (see the Criterion 4 Summary) (CORA 2023b)(MDNR 2018)(United States v. Michigan 2023)(LMLTWG 2021).

Lake Whitefish

HCRs and HRGs are in place to manage the harvest limit of lake whitefish, which make up the tribal commercial catch in gillnets and trap nets set in 1836 Treaty-ceded Michigan waters (MSC 2022). Further, temporal and spatial closures are in place to protect stocks, and detrimental food web impacts from harvesting the species are unlikely, but are still possible (see Criterion 4 Summary) (CORA 2023b)(MDNR 2018)(United States v. Michigan 2023).

Walleye

HCRs and/or HRGs for walleye have not been established. In addition, no temporal or spatial management strategies are in place, but detrimental food web impacts from harvesting the species are unlikely.

Therefore, ecosystem-based fisheries management has been scored a moderate concern, because HCRs and/or HRGs have not been established for all species captured and there is a lack of temporal and spatial management strategies to protect ecosystem functioning for all capture species in the tribal-licensed trap net and gillnet fisheries.

Lake Michigan | America, North - Inland Waters | United States | Stationary uncovered pound nets

Low Concern

Specific to the Michigan Department of Natural Resources, the Lake Michigan Fisheries Management Plan notes that managing such a complex resource requires an ecosystem approach that is adaptive and collaborative between fisheries management stakeholders (MDNR 2018). One of the main goals in the Michigan Department of Natural Resources Lake Michigan Fisheries Management Plan is strategic resource partnerships, with an outcome of ecosystem-based, lake-wide fishery management decisions through the Lake Michigan Committee (MDNR 2018). Also, HCRs and HRGs are in place to manage the harvest limit of lake whitefish (MSC 2022). Further, temporal and spatial closures are in place to protect stocks, and detrimental food web impacts from harvesting the species are unlikely, but are still possible (see the Criterion 4 Summary) (CORA 2023b)(MDNR 2018)(United States v. Michigan 2023). Therefore, ecosystem-based fisheries management has been scored a low concern.

**Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Bottom trawls
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Set gillnets
Lake Michigan | America, North - Inland Waters | United States | Wisconsin | Stationary uncovered pound nets**

Low Concern

Specific to the Wisconsin Department of Natural Resources, one of the five broad Lake Michigan fishery visions in the Lake Michigan Integrated Fisheries Management Plan is to have a diverse, balanced, and healthy ecosystem specifically focusing on habitat protection, native species restoration and management, and nuisance species prevention and control (LMFMT 2017). Goals and objectives with the Wisconsin Department of Natural Resources Lake Michigan Integrated Fisheries Management Plan include obtaining an abundant, diverse, and stable fish community that contains suitable habitats that are needed to satisfy the essential requirements of a species (including physical, chemical, and biological factors), identifying and restoring spawning and nursery habitats for fish species (including lake whitefish), and protecting, maintaining, and improving habitat that is beneficial to fish species (including lake whitefish) (LMFMT 2017). In addition, HCRs are in place to manage the harvest limit for both lake whitefish populations (Green Bay and Lake Michigan) that reside within the Wisconsin waters, and these are effective (WDNR 2023). Further, temporal and spatial closures are in place to protect stocks, and detrimental food web impacts from harvesting the species are unlikely, but are still possible (see the Criterion 4 summary) (LMFMT 2017)(WDNR 2023)(WDNR 2022d) (Wisconsin Natural Resources Board 2015). Therefore, ecosystem-based fisheries management has been scored a low concern.

Acknowledgements

Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Seafood Watch would like to thank seven anonymous reviewers for graciously reviewing this report for scientific accuracy.

References

Caroffino, D. 2023. Michigan Department of Natural Resources. Personal communication in October 2023 via email correspondence.

Collier. 2022. Status of Lake Sturgeon in the Lake Michigan Basin. USFWS Green Bay Fish and Wildlife Conservation Offices. Lake Michigan Committee Meeting. 23 March 2022.

CORA (Chippewa Ottawa Resource Authority). 2019. Commercial, Subsistence, and Recreational Fishing Regulations for the 1836 Treaty Ceded Waters of the Lakes Superior, Huron, and Michigan. Adopted August 31, 2000, Effective September 7, 2000, Revised March 4, 2019.

CORA (Chippewa Ottawa Resource Authority). 2022a. Appendix A Chippewa Ottawa Resource Authority Charter and Rules of Procedure of the Chippewa Ottawa Resource Authority (CORA Charter). Case 2:73-cv-00026-PLM, ECF No. 2042-2, PageID.12234.

CORA (Chippewa Ottawa Resource Authority). 2022b. Appendix B. Management Plan for the 1836 Treaty Great Lakes Waters December 11, 2022 Revised Draft ("Tribal Plan"). Case 2:73-cv-00026-PLM, ECF No. 2042-3, PageID.12247.

CORA (Chippewa Ottawa Resource Authority). 2023b. "Regulating/Enforcement." Chippewa Ottawa Resource Authority Preserving the Resource for Future Generations. July 31, 2023.
<https://www.1836cora.org/fishing/>

CORA (Chippewa Ottawa Resource Authority). 2023c. "Trap Nets." Chippewa Ottawa Resource Authority Preserving the Resource for Future Generations. August 1, 2023. <https://www.1836cora.org/trap-nets/>

CORA (Chippewa Ottawa Resource Authority). 2023d. "Gill Nets." Chippewa Ottawa Resource Authority Preserving the Resource for Future Generations. August 1, 2023. <https://www.1836cora.org/gill-nets/>

Dexter, J. L., B.T. Eggold, T. K. Gorenflo, W. H. Horns., S. R. Robillard, and S. T. Shipman. 2011. A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan. Approved by the Lake Michigan Committee, January 2011.

EPA (United States Environmental Protection Agency) 2021. Lake Michigan Lakewide Action and Management Plan. 2021 Annual Report.

Eshenroder, R. L., M. E. Holey, T. K. Gorenflo, and R. D. Clark, Jr. 1995. Fish-community objectives for Lake Michigan. Great Lakes Fisheries Commission. Special Publication. 95-3. 56 p.

Esselman, P. 2018. Development and application of a robot-assisted computer vision system to support habitat and species monitoring in the Great Lakes. Great Lakes Science Center.

Falck, M., D. Unglaube, J. Coleman, E. Chiriboga, and J. Gilbert. 2015. Ceded territory boundary GIS Version 2.1. Administrative report 15-1. Great Lakes Indian Fish and Wildlife Commission. Odanah, WI.

Froese, R. and D. Pauly. Editors. 2023a. FishBase. *Sander vitreus* Walleye. World Wide Web electronic publication. www.fishbase.org, version (06/2023).

Froese, R. and D. Pauly. Editors. 2023b. FishBase. *Coregonus clupeaformis* Lake Whitefish. World Wide Web electronic publication. www.fishbase.org, version (06/2023).

Froese, R. and D. Pauly. Editors. 2023c. FishBase. *Salvelinus namaycush* Lake Trout. World Wide Web electronic publication. www.fishbase.org, version (06/2023).

GLFC (Great Lakes Fisheries Commission). 2023a. "Fisheries Management: Working to sustain the resource." Great Lakes Fishery Commission. June 6, 2023. <http://www.glfc.org/fishery-management.php>

GLFC (Great Lakes Fishery Commission). 2007. A Joint Strategic Plan for Management of Great Lakes Fisheries. Great Lakes Fishery Commission. Miscellaneous Publication 2007-01. Revised 10 June 1997. Ann Arbor, MI.

GLFC (Great Lakes Fishery Commission). 2014. Great Lakes Law Enforcement Cooperating Across Boundaries to Protect the Fishery. Great Lakes Fishery Commission. Fact Sheet 7. Ann Arbor, Michigan.

GLFC (Great Lakes Fishery Commission). 2021. State of the Lake Report (Lake Michigan 2016-2021). Ann Arbor, MI.

GLFC (Great Lakes Fishery Commission). 2022a. Commercial Fish Production in the Great Lakes 1867-2020: Notes on Statistics. Great Lakes Fishery Commission. Ann Arbor, MI.

GLFC (Great Lakes Fishery Commission). 2022b. "Commercial fish production in the Great Lakes 1867-2020 [online database]." Great Lakes Fishery Commission, Ann Arbor, Michigan. Available: www.glfc.org/great-lakes-databases.php.

GLFC (Great Lakes Fishery Commission). 2022c. Great Lakes Law Enforcement Committee Terms of Reference. Great Lakes Fishery Commission. Law Enforcement Committee. Ann Arbor, MI.

GLFC (Great Lakes Fishery Commission). 2023b. "Lake Michigan Committee." Great Lakes Fishery Commission. June 6, 2023. <http://www.glfc.org/lake-michigan-committee.php>

GLFC (Great Lakes Fishery Commission). 2023c. "A Joint Strategic Plan for Management of Great Lakes Fisheries: Facilitating cooperation for more than 30 years—and counting!" Great Lakes Fishery Commission. June 6, 2023. <http://www.glfc.org/joint-strategic-plan-committees.php>

GLFC (Great Lakes Fishery Commission). 2023d. "Great Lakes Law Enforcement: Cooperating Across Boundaries to Protect the Fishery." Great Lakes Fishery Commission. July 24, 2023. <http://www.glfc.org/law-enforcement.php>.

GLFC (Great Lakes Fishery Commission). 2023e. "Great Lakes Law Enforcement Committee." Great Lakes Fishery Commission. July 24, 2023. <http://www.glfc.org/law-enforcement-committee.php>

GLFC (Great Lakes Fishery Commission). 2023f. "For Our Partners." Great Lakes Fishery Commission. July 25, 2023. <http://www.glfc.org/for-our-partners.php>

GLFC (Great Lakes Fishery Commission). 2023g. "Upcoming Meetings." Great Lakes Fishery Commission. July 25, 2023. <http://www.glfc.org/future-meetings.php>

Gonia, T. 2023. Michigan Department of Natural Resources. Personal communication in January 2023 via email correspondence.

Hansen, S. 2023. Wisconsin Department of Natural Resources. Personal communication in March 2023 via email correspondence.

Haxton, T. and R. Bruch, 2022. *Acipenser fulvescens*. The IUCN Red List of Threatened Species 2022: e.T223A58134229

Hayes, D. B., and D. C. Caroffino. 2012. Michigan's Lake Sturgeon Rehabilitation Strategy. Michigan Department of Natural Resources Fisheries Division. Special Report 62. Lansing, MI.

Hrabak, T. K. 2022. From Bay to Boat: An assessment of commercial catch in Green Bay, Lake Michigan. Master's thesis. University of Wisconsin-Green Bay, Green Bay, Wisconsin.

Jescovitch, L., S. Moen, and T. Seilheimer. 2022. "Today's Great Lakes commercial fishing and fish processing industries look to future." Michigan Sea Grant, Michigan State University Extension. October 30, 2023. <https://www.canr.msu.edu/news/today-s-great-lakes-commercial-fishing-and-fish-processing-industries-look-to-future-msg22-jescovitch22>

Lenart, S. 2022. Michigan Department of Natural Resources. Personal communication in October 2023 via email correspondence.

LMFT (Lake Michigan Fisheries Management Team). 2017. Lake Michigan Integrated Fisheries Management Plan (2017-2026). Bureau of Fisheries Management. Wisconsin Department of Natural Resources, Administrative Report No. 80. Madison, WI.

LMLTWG (The Lake Michigan Lake Trout Working Group). 2021 Lake Michigan Lake Trout Working Group Report. Great Lakes Fishery Commission. Ann Arbor, MI.

Madenjian, C. P. (ED). 2019. The state of Lake Michigan in 2016. Great Lakes Fishery Commission. Ann Arbor, MI.

MDNR (Michigan Department of Natural Resources). 2018. Lake Michigan Fisheries Management Plan. Lake Michigan Basin Team: Fisheries Division. Lansing, MI.

MDNR (Michigan Department of Natural Resources). 2019. "Showcasing the DNR: On patrol with the DNR's Great Lakes Enforcement Unit." Michigan Department of Natural Resources. July 24, 2023. <https://content.govdelivery.com/accounts/MIDNR/bulletins/2557316>

MDNR (Michigan Department of Natural Resources). 2020. Law Enforcement Division Annual Report. Michigan Department of Natural Resources, Annual Report. Lansing, Michigan.

MDNR (Michigan Department of Natural Resources). 2021. Fisheries Order: State-Licensed Commercial Fishing Order 243.21A.

MDNR (Michigan Department of Natural Resources). 2023a. "Tribal Coordination." Michigan Department of Natural Resources. February 23, 2023. <https://s3-us-west-2.amazonaws.com/sfw-images/reportsresources/27855/references/2022%20MDNR%20Tribal%20Coordination.pdf>

MDNR (Michigan Department of Natural Resources). 2023b. 2023 Michigan Fishing Guide. Michigan Department of Natural Resources. Lansing, MI.

MDNR (Michigan Department of Natural Resources). 2024a. Lake Trout. State of Michigan.

MDNR (Michigan Department of Natural Resources). 2024b. Lake Whitefish. State of Michigan.

MDNR (Michigan Department of Natural Resources). 2024c. Walleye. State of Michigan.

Michigan Sea Grant. 2023. "Commercial Fishing." Sea Grant Michigan. February 23, 2023. <https://www.michiganseagrants.org/topics/fisheries-and-aquaculture/commercial-fishing/>

Michigan Sea Grant. 2023a. "Commercial Fishing Net Safety." Sea Grant Michigan. August 1, 2023. https://s3-us-west-2.amazonaws.com/sfw-images/reportsresources/27855/references/2023%20MSU%20Commercial%20Fishing%20Net%20Safety%20_%20Michigan%20Sea%20Grant.pdf

Michigan Sea Grant. 2023b. "Lake Michigan." Sea Grant Michigan. October 6, 2023. <https://www.michiganseagrants.org/topics/great-lakes-fast-facts/lake-michigan/>

Michigan Sea Grant. 2024. Lake Whitefish.

MSC (Modeling Subcommittee). 2022. Technical Fisheries Committee Administrative Report 2022: Status of Lake Trout and Lake Whitefish Populations in the 1836 Treaty-Ceded Waters of Lakes Superior, Huron and Michigan, with Recommended Yield and Effort Levels for 2021 and 2022. Report to the Technical Fisheries Committee. Ann Arbor, MI.

NOAA (National Oceanic and Atmospheric Administration). 2023. "Wisconsin Shipwreck Coast National Marine Sanctuary." National Marine Sanctuaries. October 6, 2023. <https://sanctuaries.noaa.gov/wisconsin/>

Redman, R. 2023. Harvest of Fishes from Lake Michigan during 2022. Great Lakes Fishery Commission Lake Michigan Committee. Upper Lakes Committee Meeting. March 21-24, 2023.

Seilheimer, T. 2019. Harvest and bycatch associated with bottom trawling for Lake Whitefish in Lake Michigan from 2015 to 2018. Wisconsin Sea Grant. UW Green Bay/Manitowoc Campus. Manitowoc, WI.

Seilheimer, T. 2023. Wisconsin Sea Grant. Personal communication in August 2023 via email correspondence.

Stroess, R. 2023. Wisconsin Department of Natural Resources. Personal communication in October 2023 via email correspondence

The Ojibwe People's Dictionary. 2012-2021. Copyrighted by The Ojibwe People's Dictionary:
<http://ojibwe.lib.umn.edu>

United States v. State of Michigan. 2023. W.D. Mich. Case No. 2:73 CV 26. United States District Court. Western District of Michigan. Southern Division.

US and OCI (Government of the United States and Government of the Ottawa and Chippewa Indians). Treaty with the Ottawa, etc. Washington, D.C.

Wang, L., C. M. Riseng, L. A. Mason, K. E. Wehrly, E. S. Rutherford, J. E. McKenna Jr., C. Castiglione, L. B. Johnson, D. M. Infante, S. Sowa, M. Robertson, J. Schaeffer, M. Khoury, J. Gaiot, T. Hollenhorst, C. Brooks, M. Coscarelli. 2015. A Spatial Classification and Database for Management, Research, and Policy Making: the Great Lakes Aquatic Habitat Framework. *Journal of Great Lakes Research* 41(2):584-596

WDNR (Wisconsin Department of Natural Resources). 2008. Walleye (*Stizostedion vitreum vitreum*). Bureau of Fisheries Management, PUBL-FM-708 08, Madison, WI.

WDNR (Wisconsin Department of Natural Resources). 2012. Terms of Reference: Lake Michigan Fisheries Forum. Lake Michigan Fisheries Team, Madison, WI.

WDNR (Wisconsin Department of Natural Resources). 2022a. Lake Michigan Management Reports. Lake Michigan Committee, 2022 LMTC Summer Meeting, Milwaukee, WI.

WDNR (Wisconsin Department of Natural Resources). 2022b. Division of Public Safety and Resource Protection: Strategic Plan 2022-2023. WDNR, Madison, WI.

WDNR (Wisconsin Department of Natural Resources). 2022c. Annual Report 2022. Division of Public Safety and Resource Protection, WDNR, Madison, WI.

WDNR (Wisconsin Department of Natural Resources). 2022d. Chapter NR 25: Commercial Fishing. WDNR, Published under s. 35.93, Wis. Stats., by the Legislative Reference Bureau, Madison, WI.

WDNR (Wisconsin Department of Natural Resources). 2023. Lake Michigan Management Reports. Lake Michigan Committee, 2023 Lake Michigan Technical Committee Summer Meeting, Milwaukee, WI.

Wisconsin Natural Heritage Program. 2021. Wisconsin Natural Heritage Working List. Bureau of Natural Heritage Conservation, WDNR, Madison, WI.

Wisconsin Natural Resources Board. 2015. FH-10-15. WDNR, NR 25.09: SS 049-15, Madison, WI.

Wisconsin Sea Grant. 2023. "Trap Nets." Sea Grant University of Wisconsin. August 3, 2023.
<https://www.seagrant.wisc.edu/our-work/focus-areas/fish-and-fisheries/trap-nets/>

Zimmerman, M. S. and C. C. Krueger. 2009. An Ecosystem Perspective on Re-establishing Native Deepwater Fishes in the Laurentian Great Lakes. *North American Journal of Fisheries Management* 29:1352–1371